JUNE . . . 1963

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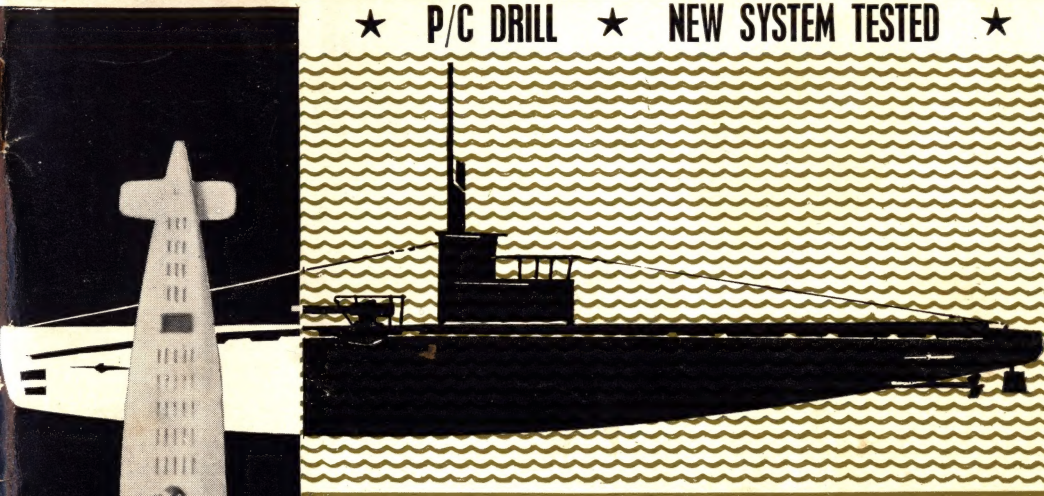
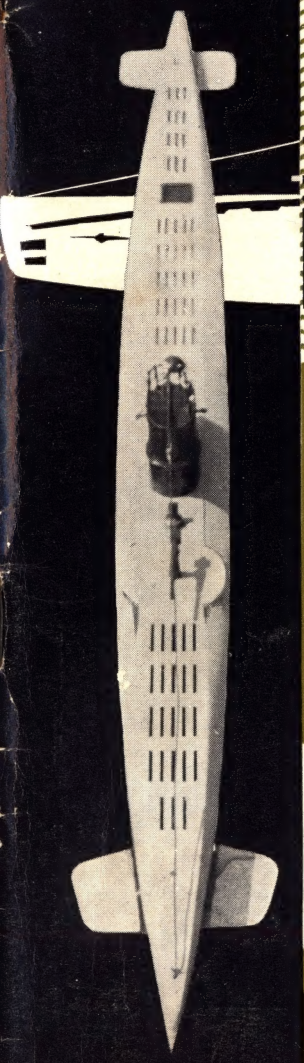
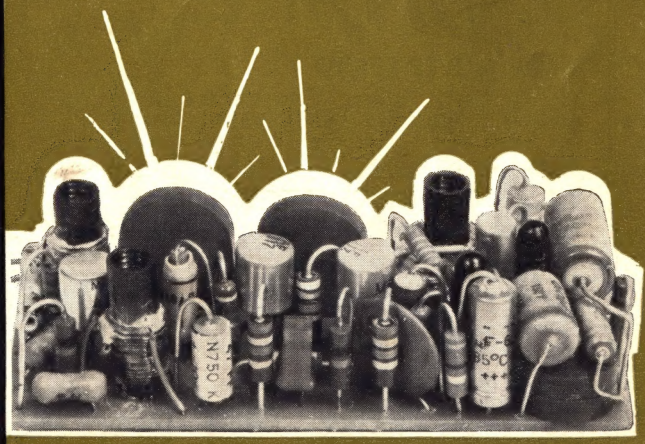




Submarines



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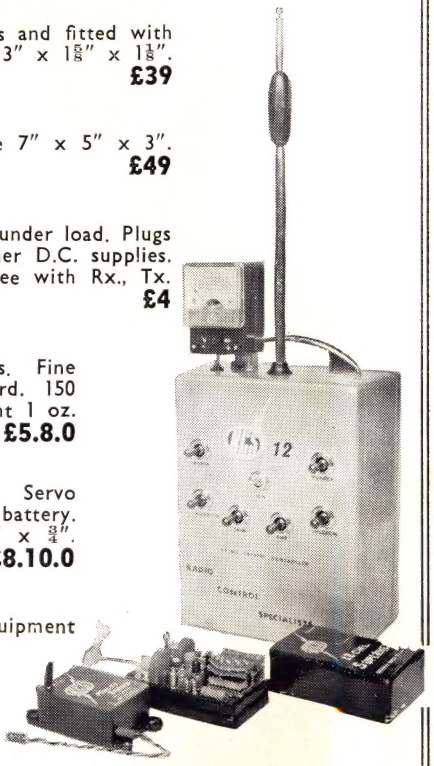

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RADIO CONTROL MODELS & ELECTRONICS

JUNE
1963

VOLUME 4 NUMBER 6

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TWO SERVO PROPORTIONAL SET
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Plus the usual favourites

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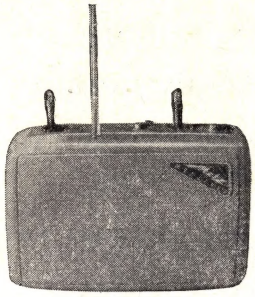

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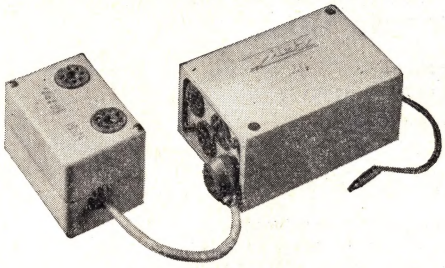

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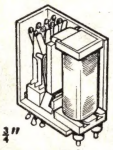

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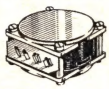

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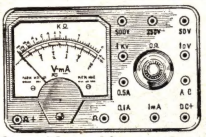

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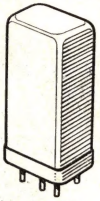

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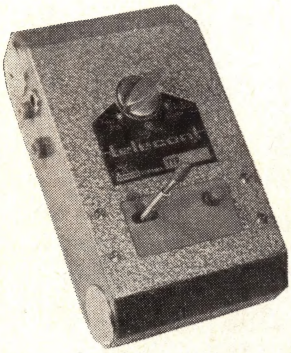
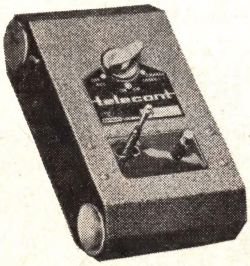


5 channel



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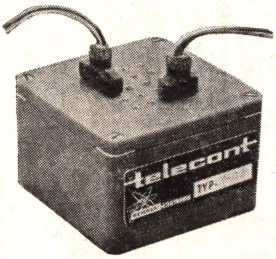

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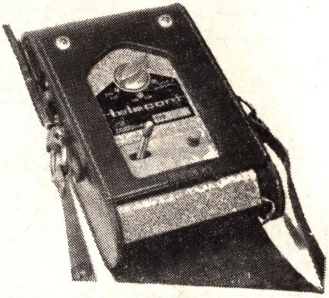

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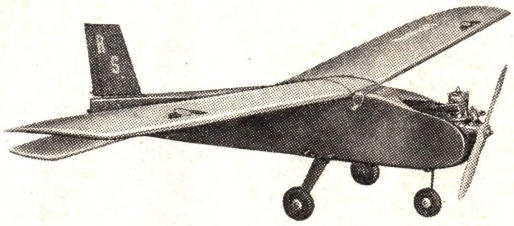

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Here, There & Everywhere

Are You?

Can you place your hand on your heart and say "I currently hold a licence for model control transmitters"? In spite of the fact that almost every month we publish a little reminder to the effect that one must have a transmitting licence if one has a radio control transmitter. We are sure there may be quite a few modellers and experimenters who possess transmitters and who have not yet obtained the necessary licence. Recently, the Post Office gleefully announced the fact that they had issued to date some 5,000 licences. Our readership figures have now climbed to around the 16,000 mark, surely more than just a third of our readers own a transmitter, to say nothing of transmitter owners who restrict their reading matter to other modelling publications. Manufacturers say they sell something like 20 or 30 outfits a week, where do they all go? We would hardly think modellers buy them as status symbols to decorate their workshop . . . .

We hear talk of frequency allocation for Citizen's band use, and in order to maintain a strong case for our own use of the 27 Mc/s. band, we feel that the number of licence *holders,* already justifying our allocation, might be a little higher and hence strengthening our argument. We would like to be quite sure that not only all operators are holders of a licence, so giving an exact indication of their number, but that they are all conversant with the regulations governing the use of such equipment. These rules are, happily, quite simple and not particularly restricted. The situation on the Continent is that transmitters must pass a rigourous test in order to comply with Post Office regulations. We urge all would be transmitter designers to adopt crystal control as a necessary feature of the design. Most new commercial examples are so designed and if at any time it becomes compulsory to have crystal controlled equipment, then modellers with this kind of equipment would not be caught napping. Crystal control is not particularly difficult, but if misapplied can prove most unsatisfactory in (for example) circuits not intended for such a modification. Always seek the advice of experts, and always set up your transmitter on equipment which you know is reliable and on frequency. We have a frequency checking service for lone hands who are unable to enlist the services of any club member with the necessary gear.

Remember, you still need a licence if the transmitter is capable of being operated, even if you do not intend to use it just yet. Any consciences pricking?

Tri Motored Aircraft

We are informed by the Sutton Coldfield R/C M.A.C. of an experimental aircraft belonging to club member Wilf. Jones, this recently swept the dust from the airfield runways when with all motors in full song, the *Tri motored* model became airborne, climbing steadily on its two Cox Olympics and one Super Tigre 56. After reaching a comfortable altitude the main motor was throttled back and Wilf was able to give an aerobatic display on power from the two outer engines.

An interesting feature is that no special link was used between the motors. When eventually one of the outer motors cut, it was possible to counteract uneven thrust by the normal full size procedure of applying opposite rudder. A perfect three point landing was made with the main motor throttled back, and an excellent maiden flight was completed.

No doubt many people will remember seeing this model perform at the Sutton Coldfield Carnival. Appropriately named "Miss Sutton Coldfield", it is under Orbit 8 channel control, with a wing span of eight feet and looks very graceful when aloft. It now remains to be seen if the "Trimo" experiment collects more recruits.

Bristol R/C Rally

The second Annual Rally will be held by the Bristol Radio Controlled Model Aircraft Club on Sunday, July 14th, at R.A.F. Hallavington. The programme will consist of Multi, Scale and Single to F.A.I. Schedule.

Pre-entries at five shillings each to:

W. Bellinger,
48 Stirtingale Road,
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On the Cover

Just for a change we have used a submarine, the details of which appear in this issue. In fact with apologies to our companion magazine "Aeromodeller" we feel we should entitle it *"Under* the Waves".

Subs. have been a little neglected, but are not entirely practical. For, given clear water, a reasonably powerful transmitter combined with a sensitive receiver, control may be maintained at *visual* range. This, in the case of a submarine, is quite short when submerged, and in any case, operating at periscope depth is quite interesting. Naturally, on the surface, range should be similar to an orthodox craft but aeromodelling enthusiasts have the added attraction of an "Elevator". This brings us to remark that there must be several useful subjects for radio control in other fields which have not really been developed fully. For example: model race cars, land yachts to say nothing of humorous applications such as "George" the R/C Dragon, which appeared in a very early issue of ours, and R/C as applied to some of the "Model Maker" series of "space models". The superhet is an experiment by J. H. Brunt and introduces D.I.Y. readers to the use of transfilters. Great strides are being made in this direction and in this country one commercial example is already available.

Slade Radio Society

D. D. S. Williams (Honorary General Secretary) 117 The Boulevard, Wylde Green, Sutton Coldfield, once again draws modellers' attention to the Slade Radio Society's activities for the future few weeks, which are as follows:

May 8th *Amateur Television.* Lecture and demonstration by Mr. B. W. Smith, B.Sc., G3LGJ/T in collaboration with Mr. J. E. Smith, B.Sc., G3JZF (member).

May 17th *Evening D.F. Test.* Details to be announced.

May 31st *Welsh Safari with Radio.* By Mr. T. P. Douglas, M.B.E., G3BA.

June 14th *How I got on the Air.* A relation of their experiences by newly licenced members.

June 28th *Radio Fundamentals.* Part 6, By Mr. J. E. Smith, B.Sc., G3JZF (member).

Details from the Secretary. (Visitors to the Society's Meetings, which commence at 7.45 p.m. prompt, and to the Club Station, are cordially welcome). Headquarters:— The Church House, High Street, Erdington, Birmingham 23.

Calling all Boat Enthusiasts

"How about a Gannet Owners Club?" asks E. J. Yeldham. Well, we put it to you. There are quite a lot of Gannets about although a club would be rather scattered, as Gannets do not appear to be a particularly regional choice when it comes to power plants, so it might make things a little difficult for competitions which are envisaged as part of the activities of such a club. We suggest that interested Gannet owners write to E. J. Yeldham at 37 Rayleigh Road, Woodford Green, Essex.

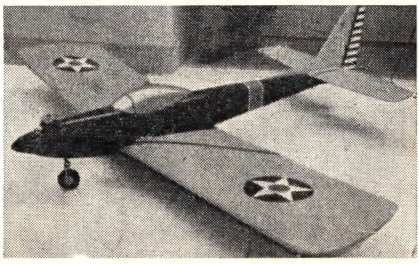
Sutton Coldfield Rally Cancelled

Sorry chaps, the airfield has been ploughed. The Secretary offers his apologies. More information next month.

Jerry Goes Proportional

Our photograph shows "Pharoah", Jerry Nelson's latest model designed to take proportional equipment. In his recent letter to us, he tells us that he is sampling a Sampey 404, a Spreng-Mathis Digacon and an Orbit Proportional. His plan is to try all the radios which would appear to suit this model and then keep the system he wants. (*Editor turns green with envy*!) Factors which are very important are, servo response time and control stick layout.

"Pharoah" is scheduled for a Sampey 404 and is about the size of the "Sultan" although it has a longer nose and tail moments, larger fin and elevator.

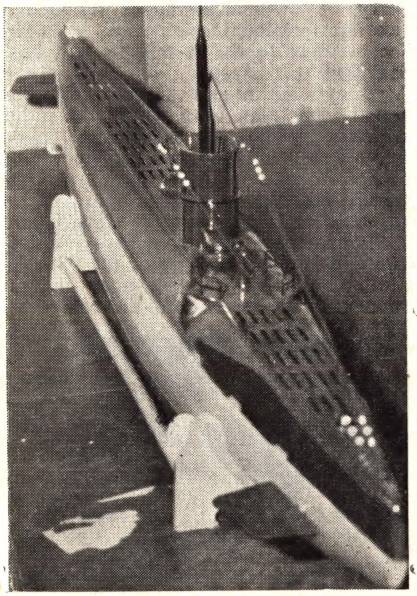


Under ~~Over~~ the Waves

. . . with apologies to "Aeromodeller"!

Two Submarines: One for single channel by Tony Kingett one for Multi by D. A. Tudor

RADIO CONTROL Submarines seem to have been a little neglected as regards space in our pages, so we take this opportunity of introducing two just to show that submarines can be controlled by radio with some measure of success. We are fortunate in that there are several suitable plans in the "Model Maker" range, and for those modellers who prefer to build from kits, the Schuco range includes a comprehensive kit with a complete deck and superstructure unit moulded from plastic. The hull is sufficiently capacious to accommodate a variety of control systems, and two examples of radio when applied to this kit appear in this article. First, the simple approach; Tony Kingett of R.E.P. fitted a Mini-Reptone, a receiver quite easily affected by impulse interference, and is not normally recommended for use with motorised actuators or in close proximity to other sources of interference such as driving motors. However, the main driving motors (a pair of Marx "Super Monoperms") were carefully suppressed and the receiver positioned far up in the bows. The output was wired to operate 75 ohm R.E.P. relay which switches a "Unimite" for steering. The receiver is still subject to some interference, however, and the latest installation which we have photographed uses a relay version of the "Gemini" with, naturally, no interference problems.



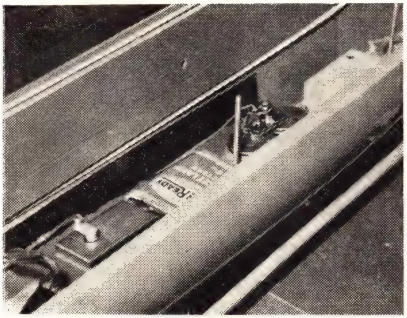
Tony Kingett's version of the Schuco kit. The aerial is lead from the bows to the periscope, so the for'd part must be submerged at times . . .

We understand that this submarine is not ballasted sufficiently to dive since the equipment used is of the lightweight variety and more ballast will be needed despite the half dozen 4.5 volt batteries it carries for power supplies. With the "Gemini" installed, still more ballast is required, with the DEAC power pack shown in the photograph.

The next Schuco example is the work of D. A. Tudor, so now for his description of a 6 channel version:

Being a radio control enthusiast with the emphasis on equipment building rather than on model building, I was on the look-out for a pre-fab. kit which was something out of the ordinary. When I came across the "Schuco U25" submarine kit I was immediately impressed and purchased a basic kit.

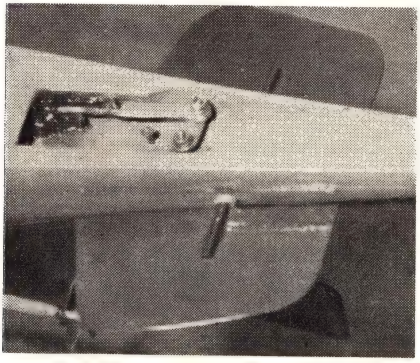
The hull is of preformed obechi, the hatch of marine ply, the deck of moulded plastic and the fittings, etc., made up of odd pieces of plastic and

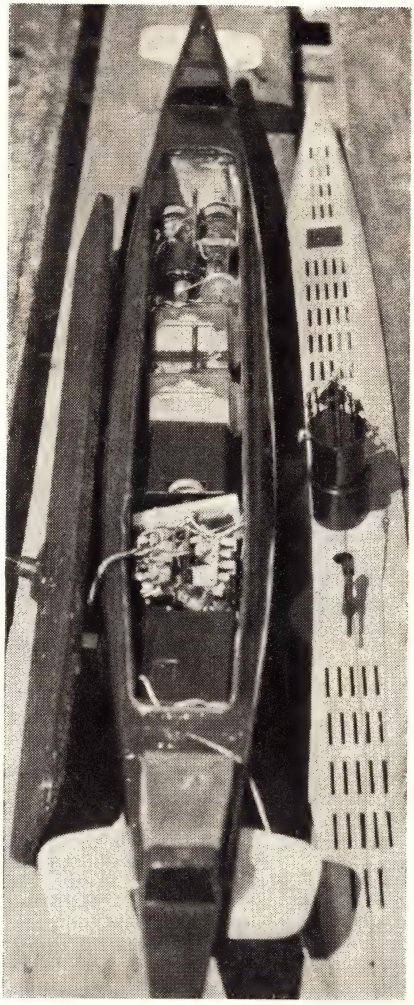


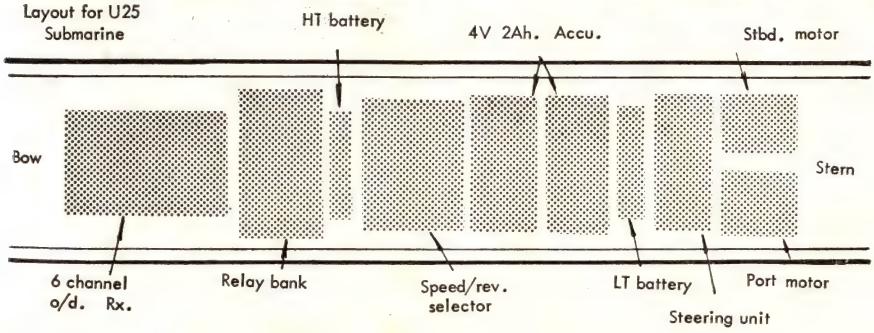
Above : The "Gemini" and "Unimite" installation . . . plenty of space for extra batteries and ballast.

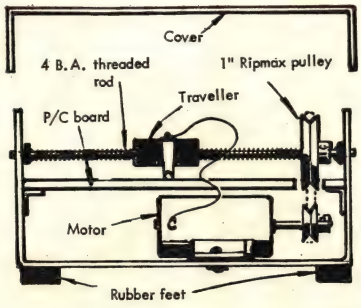
Below : Special tiller linkage with push-rod passing through a grease filled tube.

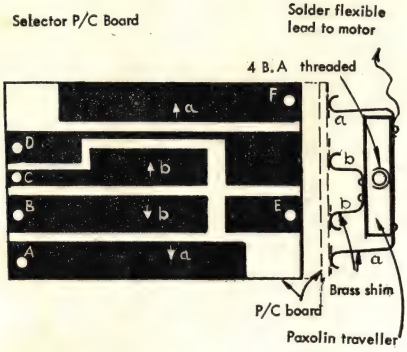
Right : The Tudor version, well packed with equipment, see the installation diagram at the bottom of the page for identication of the components.





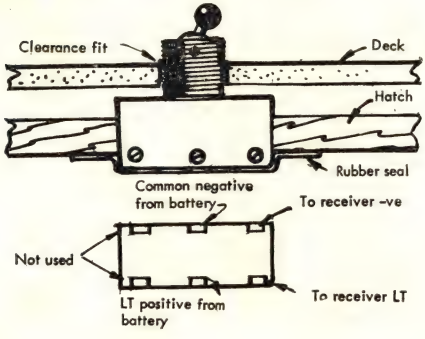


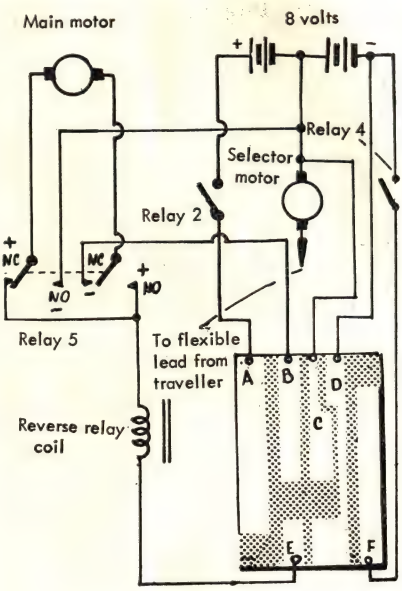




brass. The power is derived from 2 x 4v. 2 AH accumulators and two small but very powerful motors provide the drive.

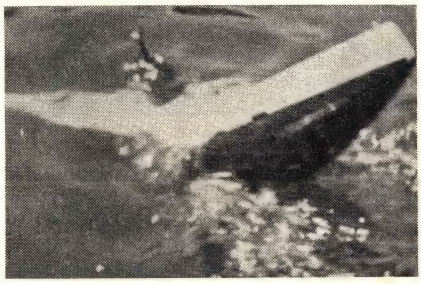
Due to the small amount of space available all the radio equipment had to be miniaturised and the finished products although somewhat unorthodox have proved quite reliable during testing. The radio is 0/D 6 channel, so are the two servos.



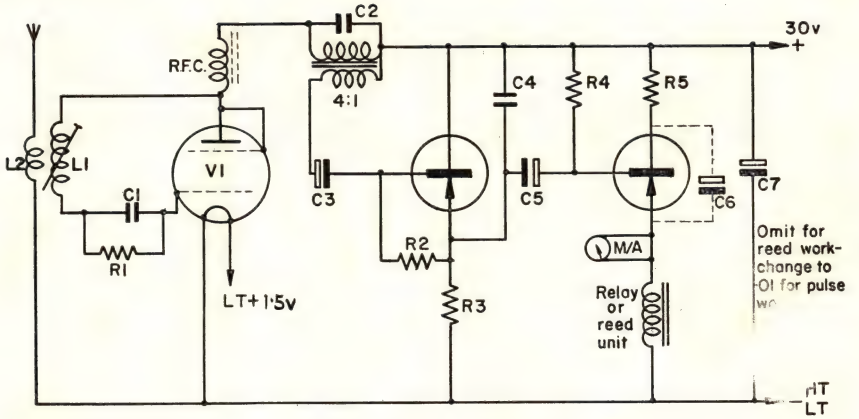


Steering and Speed Selector Servo Details.

The steering servo is of the normal lead-screw type but due to the very small amount of movement permissible the output was taken via a "L" shaped lever to the rudder pushrod. The rudder movement is approximately 12° port and starboard. The whole unit is



Splooosh ! The Tudor model surfaces at speed. The photo was taken just as it settled back after pushing its bows high out of the water. It is the refraction of the water that makes it appear sadly bent. Some "Subs" may leap almost out of the water when surfacing from 'way down'. We would favour a long insulated whip aerial for this treatment. Water proof radio switch is shown left.



COMPONENTS AND REMARKS

V1: XFY34 or equivalent.
Tr1: OC71 — OC72 — OC75.
Tr2: OC71 — OC72 — OC75.
Transformer: 4:1 or approx.
R1 } depends on valve and r.f.c.
C1 } start at 2.2 mΩ and 30 pf.
R2: 2.2 mΩ.
R3: 4.7 KΩ.
R4: 4.7 KΩ depends on Iebo of T2.
R5: 33 Ω may be omitted.
C2: 0.005 μf.
C3, C5 C6: 2 μf. (see remark for C6).
C4: 0.01 μf.
C7: 5 - 8 μf. 30 VW.
L1: Ready wound 27 Mc/s. ¼ in. dia. coil.
L2: 2 - 3 turns on L1.
Battery: H.T. 30v. L.T. 1½v.
Switch: D.P. (Negatives and L.T. +ve switched).

Standing Current: 0.2 mA. - 0.75 mA. Current Change: 2 x OC71s 4 mA. in 4 KΩ Relay. R1 and C1 determine sensitivity: Choose so the set is just oscillating. Range with a standard 90v. H.T. Tx.: Over normal visual range.

mounted on a ply base and is easily removable for servicing.

The speed selector is rather like a recent commercial one, although it was first used about 18 months ago, it is again a lead-screw unit with a traveller having two independent wipers on it. These wipers control (a) the traveller movement and (b) the voltage switched to the motors.

Both units are fully progressive, although on the speed selector only four positions are used at the moment, i.e., Rev: off: ½ ahead: full ahead. The selector has to pass through the off position before going into reverse, this is necessary due to the loading of the motors. Only 4v. is fed to motors on reverse.

The radio is switched on or off from a double pole switch which is fixed to the watch and protrudes through the upper deck. It is waterproofed by dismantling and packing the toggle with waterproof grease. The aerial is fed out through the front of the hull and the end of the plastic melted over the wire, on no account must the wire come into contact with the water.

The sub. only submerges at full speed, the depth and rate of dive is controlled by the hydrovanes and once under the surface it can be brought up again either by reducing speed or putting into a tight turn. I have found it to be controllable at quite a depth although it will resurface on its own due to the drag of the conning-tower and deck design.

The hatch is kept watertight by a rubber seal which is supplied with the kit, but I found that an extra gasket was required and that the hatch had to be sealed with thick grease. This may sound inconvenient at first, but once sealed the hatch need not be disturbed.

Experimental Superhet . . .

A CIRCUIT TO SET THE EXPERTS TINKERING

By J. H. BRUNT

Until recently, there has been very little information on the use of Transfilters for superhets. We have received many enquiries for a do-it-yourself superhet, and welcome the result of a spot of research by J. H. Brunt to start our more experimentally minded readers on a practical approach.

THE main object of this design is to provide a basis upon which the more advanced constructors of radio control equipment can build using their own variants and ideas. At the same time providing a practical unit which really works and can be used with additional channels if these are required.

The layout is arranged to be compact, but with room around the I.F. and R.F. stages for modification (some people favour crystal control for receiver oscillators). One modification visualised but not yet in its final form in the use of a Zener diode to stabilise the supply voltage to the self oscillating mixer stage. The Transfilters were employed for two main reasons, one; to save weight and space, and two; to reduce alignment problems to a minimum. The series tuned A.F. filter was used because it is easier to achieve a good selectivity providing the circuit is fed from a low impedence source, and further stages are easily paralleled from a common low impedence source without the use of additional components to isolate the filters one from another as is necessary when parallel tuned filter circuits are employed.

No originality is claimed for the individual circuits employed only the way in which they are combined.

Apart from the use of Transfilters, the R.F. and I.F. circuitry is taken from the Mullard Publication 100 Kc/s - 100 Mc/s pages 16-19 and 10. The series tuned A.F. filter is based on the fact that series tuned filter circuits are widely used in Telecommunications practice, in many types of filter circuits.

In fact I am surprised that with transistors being in common use for radio control equipment, that series tuned A.F. filters have so far been employed so little. Providing good quality components and transistors are employed in the construction, the sensitivity of this receiver should be in the order of 10-20 microvolts input to give a 300 mA. current rise in a 10 ohm D.C. resistance actuator coil.

Note: R1 was at first 10K ohm but was increased to 33K ohms when it was found that this gave a great improvement in sensitivity.

Coil Construction

(Transfilter Superhet).

All coils are wound on ¼ in. dia. formers having dust cores for tuning. Fig. 4A, B and C gives details of the construction of Aerial Coil (A), Oscillator Coil (B), and I.F. Output Transformer (C). Note: If so desired the I.F. Transformer may be a commercially produced item (this will result in slightly improved performance).

Wire gauges used are as follows:

L1—22 s.w.g. enamelled copper wire.

L2—24 s.w.g. P.V.C. covered, tinned copper.

L3, 4 & 5—32 s.w.g. enamelled copper.

L6 & 7—7 strand "Litz" wire.

All windings are in the same direction, the following gives numbering details of start and finish of winding and order of winding.

L1	Start numbered 1 Finish „ 2	}	12 turns
wound over bottom end (earthy) of L1			
L2	Start numbered 3 Finish „ 4	}	2 turns
L3	Start numbered 1 Finish „ 2	}	(earthy end) 25 turns
L4	Start numbered 3 Finish „ 4	}	9 turns
L5	Start numbered 5 Finish „ 6	}	2 turns

Each winding should be coated with Polystyrene cement and allowed to dry before proceeding with the next winding.

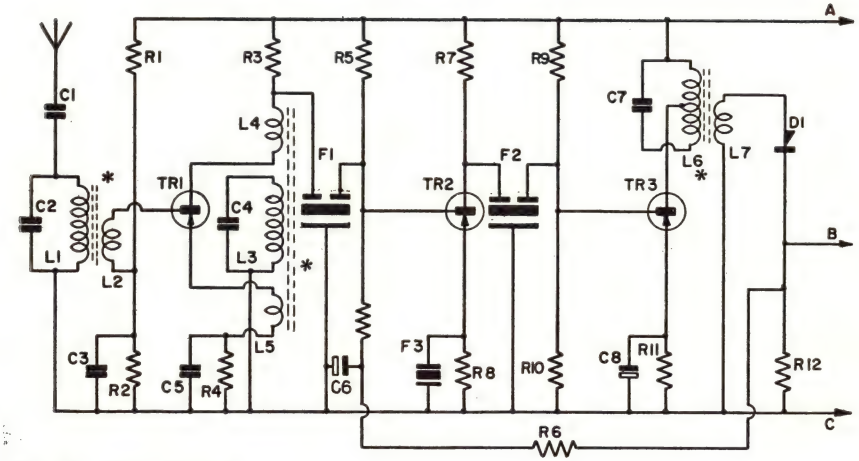
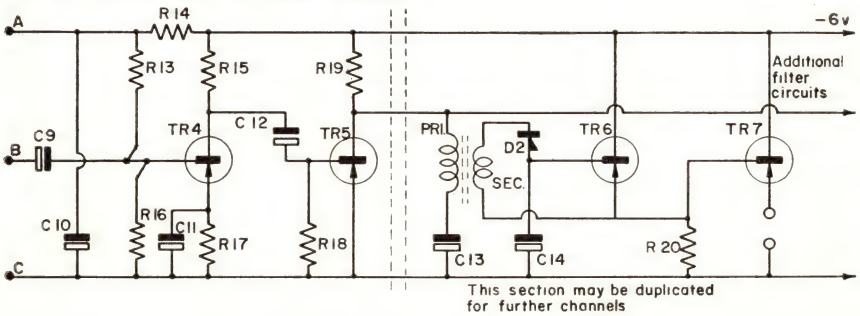


FIG. 1a. Basic Receiver

COMPONENTS LIST

R1	33K ohms	⅛ watt	R18	1.5K ohms	⅛ watt	D2	OA5
R2	2.2K ohms	,,	R19	200 ohms	¼ watt	Tr1	AF115
R3	3.3K ohms	,,	R20	1.0K ohms	⅛ watt	Tr2 & 3	AF117
R4	1.0K ohms	,,	C1	5 pf.	ceramic	Tr4	OC71
R5	56K ohms	,,	C2	33 pf.	,,	Tr5	OC72
R6	4.7K ohms	,,	C3	0.001 R.S.	,,	Tr6	OC71
R6(a)	4.7K ohms	,,	C4	47 pf.	ceramic	Tr7	S1 or GET114
R7	3.3K ohms	,,	C5	0.001 R.S.		F1 & 2	Transfilters
R8	680 ohms	,,	C6	10 mfd.	elect.		Type TO-02D
R9	22K ohms	,,	C7	720 pf.	ceramic	F3	Transfilter
R10	4.7K ohms	,,	C8	0.01 R.S.	(Disc)		Type TF-01D
R11	1.0K ohms	,,	C9	3.2 mfd.	elect.	L1-7	see text
R12	6.8K ohms	,,	C10	100 mfd.	,,	All coils wound on	
R13	33K ohms	,,	C11	32 mfd.	,,	¼ in. dia. forms with	
R14	330 ohms	¼ watt	C12	3.2 mfd.	,,	dust core tuning.	
R15	2.2K ohms	⅛ watt	C13	See text		T.	FX1011 Pot core
R16	10K ohms	,,	C14	1-10 mfd.			see text.
R17	820 ohms	,,	D1	OA81			

FIG. 1b. Add on filter Switcher Version.



Procedure for the I.F. transformer is somewhat different. First two cheeks should be made to retain windings, these cheeks may be made from thin card (e.g., a postcard will serve) and should be glued to the former approximately in the centre and ¼ in. apart.

Wind on 60 turns of wire, twist approximately 2 in. of wire to form tap (connection 2) and continue winding a further 40 turns.

L6 Start numbered 1
Tap „ 2
Finish „ 3

Lock upper turns of L6 with polystyrene cement. Now wind over L6 a further winding of 20 turns.

L7 Start numbered 4
Finish „ 5

Lock upper turns of L7 with polystyrene cement.

Fig. 5 gives details of A.F. filter coils, this drawing is self explanatory but the following tips may help in winding. To assist in holding the spool a 2 B.A. screw approximately 2 in. long with two washers and a nut, will serve to make a convenient holder which may if desired be held in a drill chuck to assist quick winding.

In order that connections to the circuit may be made without breaking the fine wire the start and finish of each winding should be provided with short leads of thin flexible wire (Litz wire may be used for this purpose). Remember when wiring that very little tension must be applied to very fine gauge wires.

Note:— When using litz wires, ensure that all strands at the ends of windings are properly cleaned and tinned, otherwise the advantages of litz wire will be lost.

P.C. Board

Fig. 2 gives the pattern for the lands when using a tuned filter output circuit, the area which includes lands 24-29 may be modified should a different output circuit be desired (e.g., a reed unit). The P.C. may be produced either by etching or knifing away the unwanted copper laminate.

Construction

Fig. 3 gives the component layout for a receiver using a tone filter circuit. (Single channel only). Extra tone filter circuit units may be paralleled on to land 24 and + land providing the circuits have a series tuned input circuit. C14 which is marked 10 mfd. can be reduced in value to 1 mfd. if quicker action is desired.

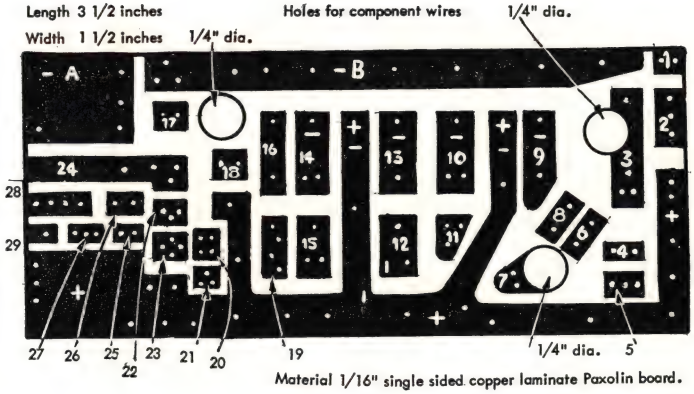
The following component to land connections are not intended to give the order of construction. (See notes under heading "Order of Construction").

Component to Land Connections

C1 land 1 — land 2.
C2 land 2 — + land.
‡L1 land 2 — + land,
‡L2 land 4 — land 3.
‡*see Fig. 4A.*
C3 land 3 — + land.
R1 – (B) Iand — land 3.
R2 land 3 — + land.
Tr1 Base — land 4, Collector — land 8, Emitter — land 6.
C4 land 7 — + land.
C5 & R4 land 5 — + land.
R3 land 9 — – (B) land.
*L3 land 7 — + land.
*L4 land 8 — land 9
*L5 land 6 — land 5
**see Fig. 4B*
F1 Input Terminal — land 9,
Centre „ — + land,
Output „ — land 10.
C6 + land — land 11.
R5 land 10 — – (B) land.
R6 land 10 — land 11.
Tr2 Base — land 10, Collector — land 13, Emitter — land 12.
R7 – (B) land — land 13.
R8 & F3 land 12 — + land.
F2 Input Terminal — land 13,
Centre „ — + land,
Output „ — land 14.
R6(a) land 11 — land 19.
R9 – (B) land — land 14.
R10 land 14 — + land.
Tr3 Base — land 14, Collector — land 16, Emitter — land 15.
R11 & C8 land 15 — + land.
C7 land 17 — land – (B).
†L6 tap — land 16, ends — land 17 & land – (B)
L7 land 18 — + land.
†*see Fig. 4C.*
D1 land 18 — land 19.
R12 land 19 — + land.
C9 land 19 — land 20.
R13 land 20 — land – (B).
C10 land – (B) — + land.
R14 land – (B) — land – (A).
R15 land 22 — land – (A).
R16 land 20 — + land.
R17 & C11 + land — land 21.
Tr4 Base — land 20, Collector — land 22, Emitter — land 21.
C12 land 22 — land 23.
R18 land 23 — + land.

FIG. 2

Full size P.C. board.



Tr5 Base — land 23, Collector — land 24, Emitter — + land.
†L7 land 18 — + land.
T Primary — lands 24, 25.
C13 land — + land.
T Secondary — lands 26, 28.
D2 land 26 — land 27.
C14 land 27 — + land.
Tr6 Base — land 37, Collector — land −(A), Emitter — land.
R19 land 24 — land −(A).
R20 land 28 — + land.
Tr7 Base — land 28, Collector — land −(A), Emitter — land 29.

External Connections

Aerial (25-30 in.) to land 1.
6 volt negative to land −(A).
6 volt positive to land +.
Actuator coil (8 ohms min. D.C. Resistance) land 29 and land +.
Additional Filter Units (must be series tuned) land 24 and land +.

Order of Construction

This will depend on whether or not a reed unit is intended to be used or whether the filter circuit given in Fig. 1 (b) is employed as in the prototype receiver. It is suggested that the I.F. stage be constructed first, starting at the Diode Detector and working towards the input, then add the self oscillating mixer and input stage. The unit may then be tested to ensure correct working. (See testing of I.F. and R.F. circuits).

Having successfully tested the I.F. and R.F. stages, the A.F. stages up to Tr4 output should be added. (See testing of A.F. stages).

Finally the tone filter and switching circuits are added. The unit may then be tested as a whole, using a 6 volt 200-300 mA. bulb as a visual indicator, or by connecting the actuator coil with a 6 volt 40 mA. (Dynamo rear lamp bulb) paralleled across the coil this will also give a visual indication without hindering the operation of the actuator.

Choice of C13

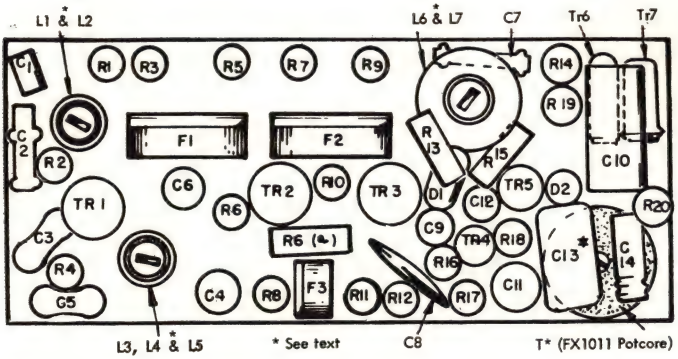
The actual value of C13 will be determined by the frequency required for the particular channel. As a guide the following figures will help. If wound as detailed in Fig. 5, the primary inductance will be approximately 0.5 Henries and it will be found that capacitors of 0.1 mfd.—1,000 pf. will tune the primary from approximately 800 c.p.s.-7,500 c.p.s.

Best results will be obtained if the modulation is pulse (square wave). The filter circuit functions better with a square wave than a sine wave input.

Testing

With the I.F. Stages completed from R3 to R12, take the end of R6 (a) to land + instead of land 19, insert a 0-250 mA. meter in the "earthy" end of R12 between R12 and + land. Using a 0.05 mfd. d.c. blocking capacitor, feed a 470 Kc/s. signal into the strip, i.e., across R3 from—(B) land and land 9. Adjust core of L6/L7 to give max. current reading on the 250 micro ammeter.

Having completed the mixer oscillator stages, feed a 27 Mc/s. signal into C1,, i.e., from land 1 to + land. Using a 400 ohm. resistor in series with the Signal Generator output. Again adjust L3 for correct frequency, taking the oscilla-



Full size

Hold page up to light to locate P.C. lands.

FIG. 3 Component layout on P.C. Board.

FIG. 4a

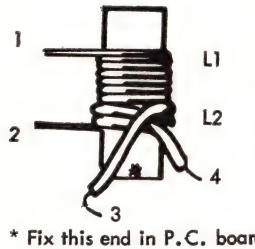


FIG. 4c

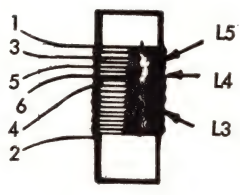
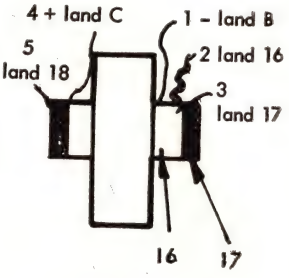
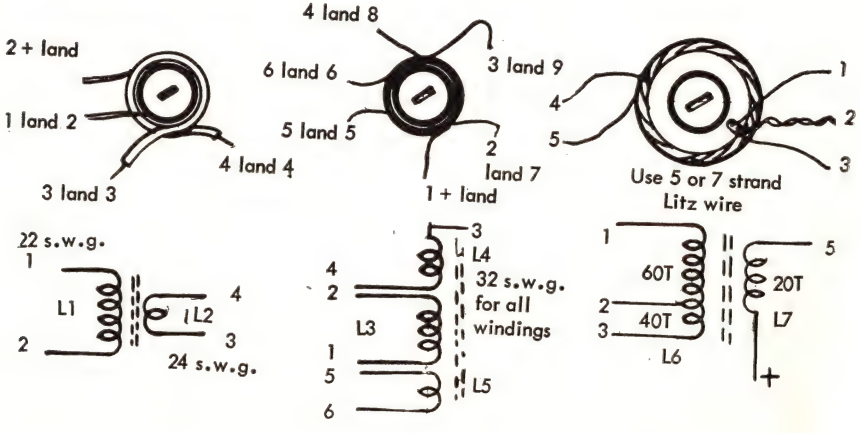


FIG. 4b





tor to the L.F. side of the signal frequency, adjust L1 for maximum current in the microammeter in series with the diode load R12 (4.7K ohms. may be used in place of 6.8 ohms. if A.V.C. action is too large using the latter). Note:—with signals greater than 20 volts and R6 (a) correctly terminated A.V.C. action will be observed, both by the behaviour of diode load current and collector current of Tr3. With the A.F. and Filter circuits complete, a 27 Mc/s. signal modulated to 90-100 per cent should be fed into the receiver. With a input of approximately 20 microvolts a voltage (A.C. range of Multimeter 3 volts 1,000 ohms. per volt) of at least 0.3 volts should be indicated with the modulation frequency set to the centre frequency of the tuned filter. This voltage to be measured from + land to land 24 with a 0.1 mfd. capacitor in series with the meter to block the D.C. Component. Further with this A.C. voltage present at the points designated; a 6 volt 300 mA. lamp connected from + land to land 29 should light to full brilliance.

Voltage Checks

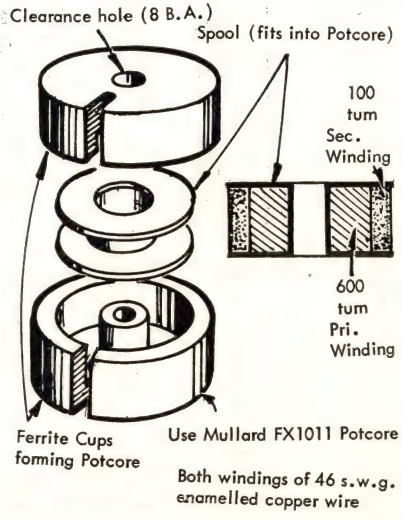
These checks were made on the prototype in the no signal condition.
Supply voltage 6 volts.
Negative prod taken to various points as indicated.
Positive prod clipped to + land.
Ranges used 3 and 12 volt full scale, meter sensitivity 20,000 ohms per volt.
Negative prod to:—
Junction C3, R2 & L2 (land 3) 0.3 volts.
„ C5, R4 & L5 (land 5) 0.4 volts.
„ F1, Tr2 base, R5 & R6 (land 10) 0.5 volts.
„ Tr2 emitter, R8 & F3 (land 12) 0.35 volts.
„ Tr2 collector, R7 & F2 (land 13) 3.0 volts.
–(b) land 4.8 volts.
Junction Tr3 base, F2, R9 & R10 (land 14) 0.85 volts.
„ Tr3 emitter, R11 & C8 (land 15) 0.65 volts.
„ Tr3 collector, L6 tap (land 16) 4.8 volts.
„ D1, R12, R6(a) & C9 (land 19) 0.13 volts.
„ C9, R13, R16, Tr4 base (land 20) 0.85 volts.
„ Tr4 emitter, R17 & C11 (land 21) 0.8 volts.
„ Tr4 collector, R15 & C12 (land 22) 3.4 volts.

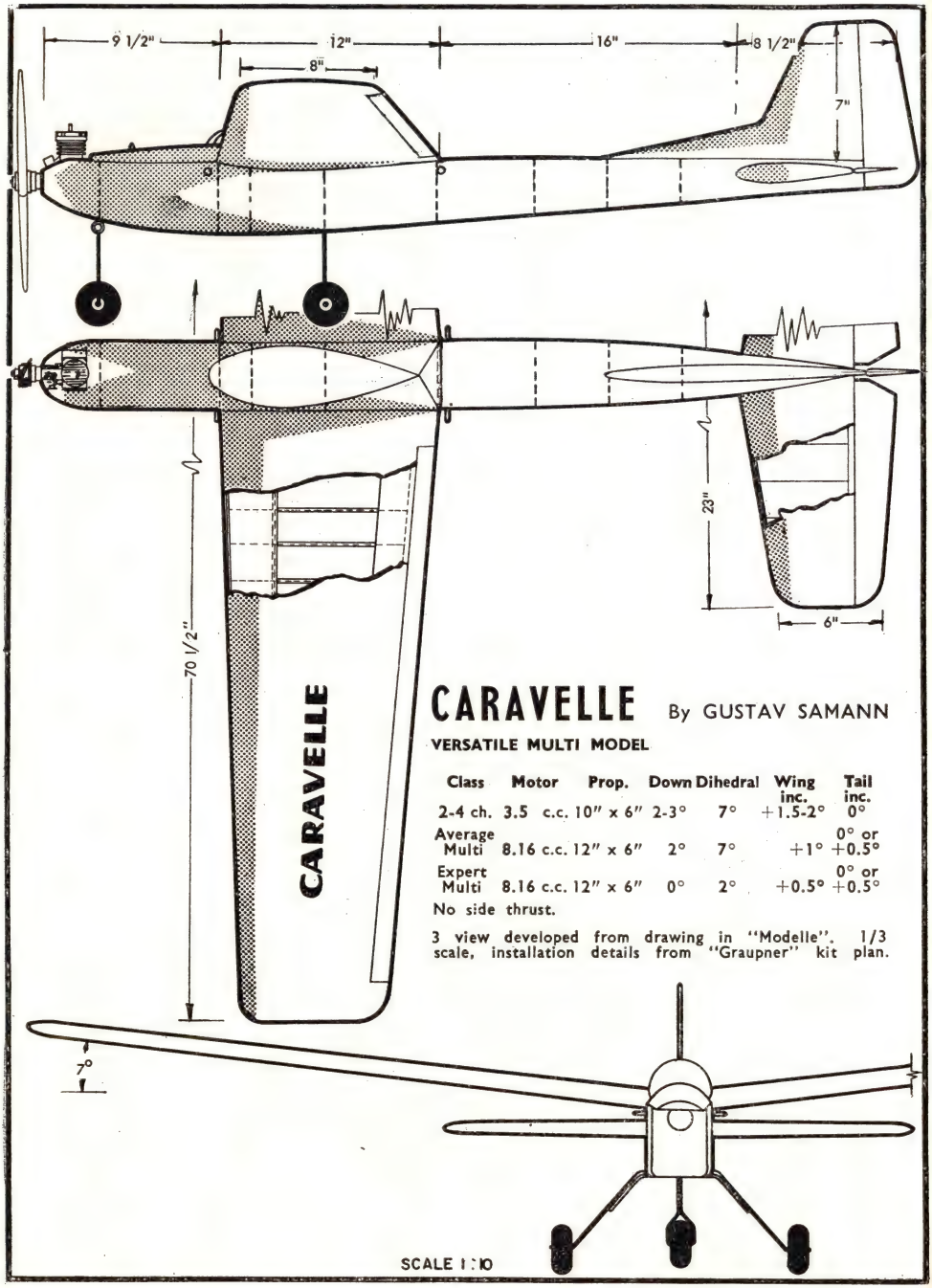
The filter switcher version of the Brunt Superhet. Although the components are widely spaced for experimental substitution, the size is not over large and there may be aeromodellers who will use it for more than one channel in reasonably sized models.

„ Tr5 base, C12 & R18 (land 23) 0 volts.
„ Tr5 collector, R19 & T* prim. (land 24) 6 volts.
„ D2, C14 & Tr6 base (land 27) 0.1 volts.
„ T* secondary, Tr6 emitter, Tr7 base & R20 0.1 volts.
„ Tr7 emitter, Actuator coil (or bulb) 0 volts.

(*Concluded on page* 300)

FIG. 5


Clearance hole (8 B.A.)
Spool (fits into Potcore)
100 turn Sec. Winding
600 turn Pri. Winding
Ferrite Cups forming Potcore
Use Mullard FX1011 Potcore
Both windings of 46 s.w.g. enamelled copper wire



CARAVELLE

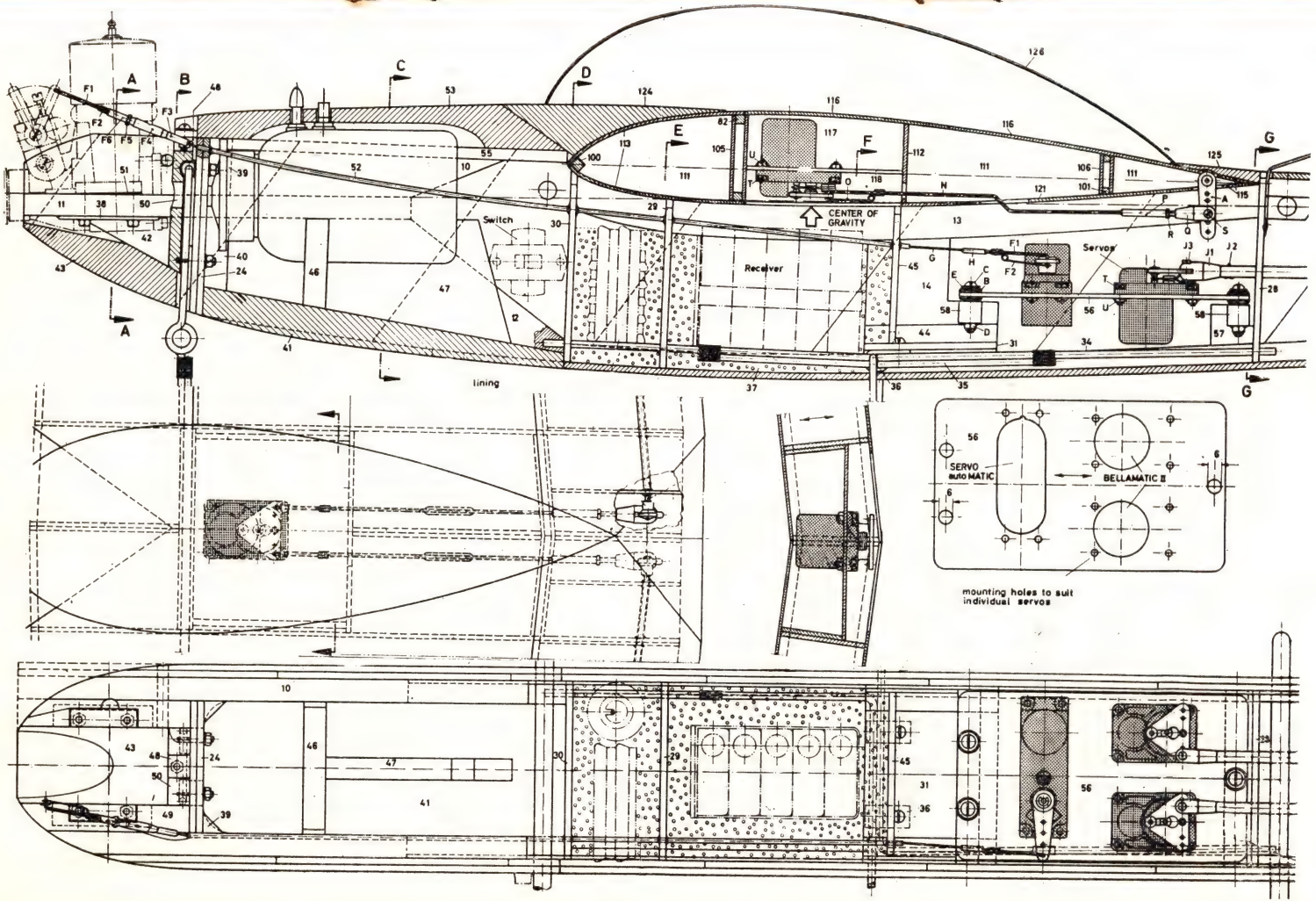
By GUSTAV SAMANN

VERSATILE MULTI MODEL

Class	Motor	Prop.	Down	Dihedral	Wing inc.	Tail inc.
2-4 ch.	3.5 c.c.	10" x 6"	2-3°	7°	+1.5-2°	0°
Average Multi	8.16 c.c.	12" x 6"	2°	7°	+1°	0° or +0.5°
Expert Multi	8.16 c.c.	12" x 6"	0°	2°	+0.5°	0° or +0.5°

No side thrust.

3 view developed from drawing in "Modelle". 1/3 scale, installation details from "Graupner" kit plan.

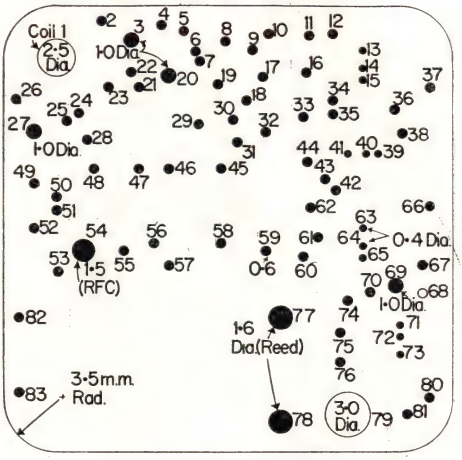

CENTER OF GRAVITY
Switch
Receiver
Servos
lining
SERVO auto MATIC
BELLAMATIC II
mounting holes to suit individual servos

'Half-Pint 8'

By G. TORTORA

PART 2

FINAL ASSEMBLY AND REED BANK



TWICE SIZE VERSION OF FIG. 3 SHOWING HOLE POSITIONS ON UNDERSIDE

THIS month concludes the building of the receiver and deals with the reed bank. The latter could probably be made in the same style but in a larger size by the less nimble fingered modellers, but remember that the length of the reeds decides the tone range!

Wiring

There is only one separate wire connection, all the other intercomponent wiring uses the component's own leads. It should be stressed that the author spent many hours in designing the layout shown in Fig. 9 and under no circumstances should this be modified.

Naturally the leads, none of which are insulated, should be neatly laid and prevented from touching each other except where soldered connections are to be made. The hatched marks on the diagram indicate where soldering is necessary. Just the merest touch with the iron and very fine Multicore solder is all that is needed for a good joint. In some cases it is best to trim the wire to length before soldering, in others it is helpful to leave a little excess length to hold while the wire is manoeuvred into the correct position. Trim off later with a sharp fine pointed knife. This does not do the knife very much good, but a neater job results than if wire cutters are used.

COMPONENT PLACEMENT

Component	Over	Bottom	Top
Coil	1	24	23
R.F.C.	54	53	55
C1	27	25	26
C2	3	2	22
C3	20	21	29
C4		8	6
C5		52	51
C6	(between)	45 &	58
C7	,,	35 &	59
C8		17	18
C9		33	35
C10		62	42
C11		67	68
C12		81	80
C13	(between)	37 &	66
R1		19	7
R2		49	50
R3		57	56
R4		30	31
R5		5	4
R6		11	12
R7		10	9
R8		6	34
R9		44	43
R10		36	38
R11		60	61
R12		74	70
R13		76	75

Transistors	E	B	C
Tr1 (case 28)	48	47	46
Tr2	15	14	13
Tr3	41	40	39
Tr4	63	64	65
Tr5	71	72	73
Reed coil between		82 &	83
Reed fixing		77 &	78
Flying lead			69
Supply leads			79
Aerial to coil tag.			

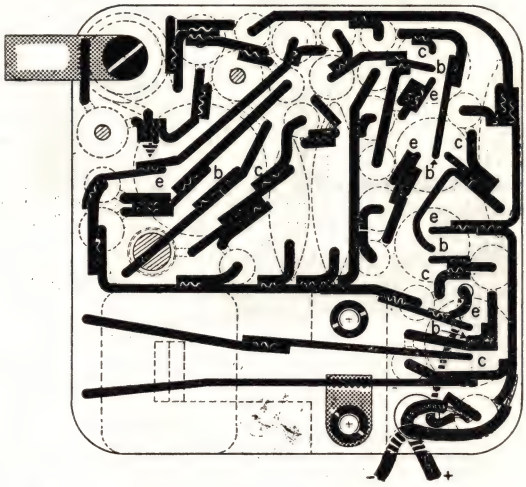
The whole of the underside of the panel may be now coated with polystyrene dope to insulate and hold the wires. The dope may be scratched clear for any testing which may be necessary later. After final testing, the upper side of the board and the components may be coated with coil dope to prevent individual components moving about. This is almost as good as potting, on so tiny a receiver.

★

FIG. 8

Position of component leads. Solder indicated by white lines.

★



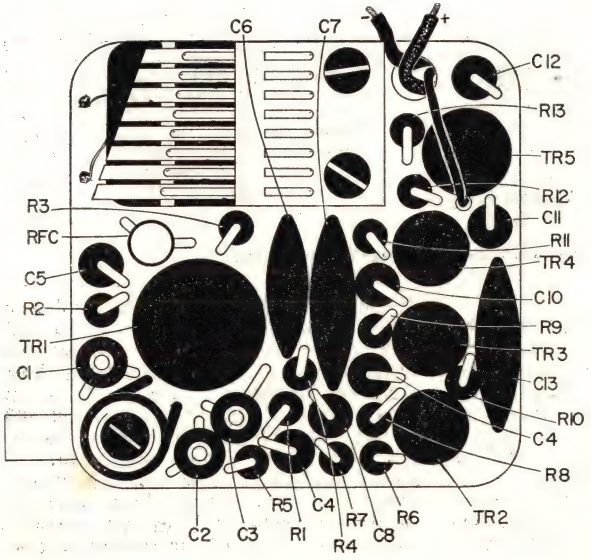


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FIG. 9

Component placement.

NOTE : C9 between R8 and R9 is incorrectly numbered C4.

★

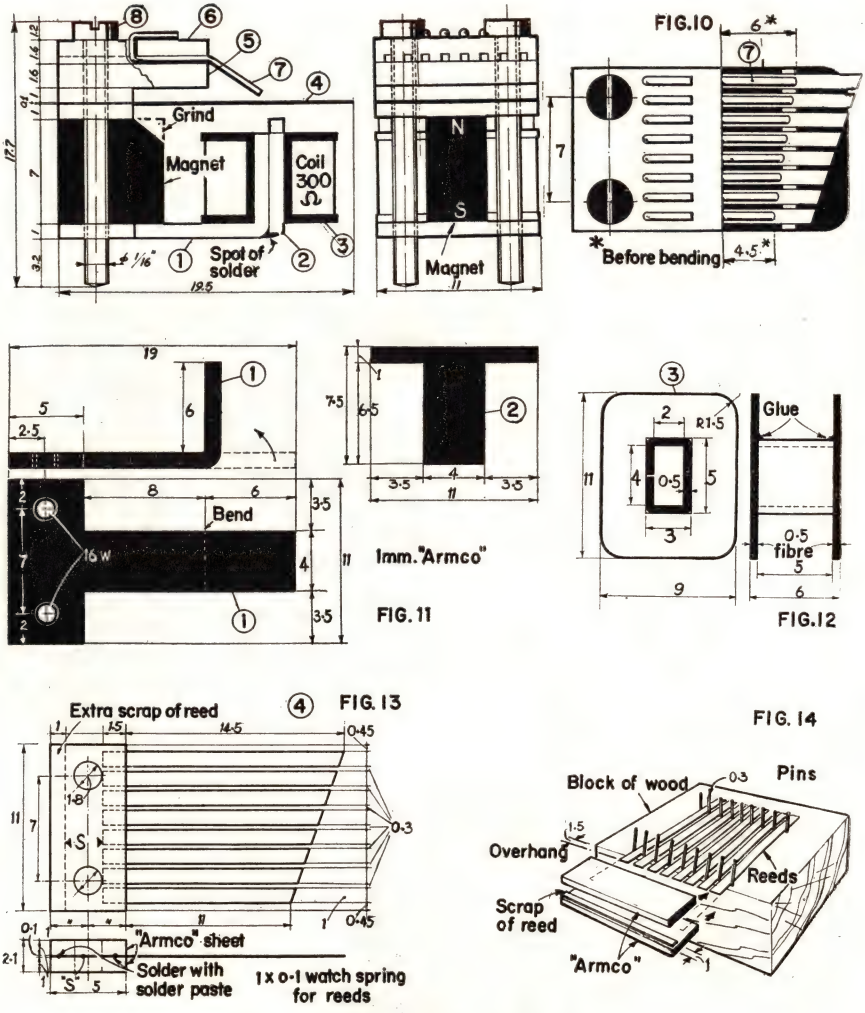


FIG. 10

FIG. 11

FIG. 12

FIG. 13

FIG. 14

All dimensions in mm.; drawings twice full size.

Reed Unit

The reed unit is claimed by the author to be the world's smallest and lightest. (It certainly is the tiniest version we have ever seen.—Ed.) Construction demands a certain amount of skill although the materials are not particularly difficult to obtain. Fig. 10 shows the components required

The components one and two are cut and filed from "Armco", the material used for electromagnets and some transformer laminations. The coil bobbin is made from fine fibre sheet, about 0.5 mm. (1/50 in. thickness). Polystyrene cement may be used to hold the three sections together. The bobbin is wound full of 0.05 mm. diameter (48 s.w.g.) enamelled copper wire, when complete it should have a resistance of about 300 ohms. The winding is terminated in two scraps of litz wire (or surplus length of a miniature transformer lead out) and the windings pro-

tected with a layer of Sellotape. The reed comb Part Four (shown in Fig. 13) is the most important part and is built in three sections; two clamping plates of 1 mm. thick "Armco", with the watch spring reeds sandwiched between. They must be soldered (Tinol was used) solder paste would do equally well after thoroughly cleaning the faces to be jointed. The jig shown in Fig. 13 is essential for correct assembly and can be saved for fellow club members to use later. Watch spring varies a little, but 0.1 mm. thickness (our guess is five thou.) and 1 mm. wide was used on the original. The spring material is black and it is necessary to put it in a bath of water with Ipocloridic acid to clean it. Now for the actual soldering, place the eight reeds on the jig with their ends overhanging the edge $\frac{1}{16}$ in. and insert it between two pieces as indicated in the diagram. Another piece 11 mm. long is inserted as shown to hold the two clamped pieces parallel during soldering. The space "S" is necessary because the 1.8 mm. diameter holes cannot be drilled easily through the spring steel reeds.

After all the reeds have been soldered in and any excess solder cleared carefully with a very fine file, it may be necessary to straighten the reeds slightly. This should be done with the fingers so as not to damage the comb. The ends of the reeds may now be cut with sharp metal shears to the correct angle to provide a frequency of between 380 and 560 c.p.s., a slightly different range may be selected but it must be borne in mind that the unit worked best at this range. The reeds may now be silver or gold plated by some kindly jeweller or industrial concern. The plating should not alter the frequency by any great amount, in any case such plating could be done with the reeds slightly longer than their final trimmed size, progressing gradually with subsequent clipping, remembering that the frequency may only be lowered again by adding a little dab of solder to the ends, which whilst practical on larger reed combs may be rather difficult in this case.

The silver wire contacts are held between two pieces of Perspex which may be cemented with chloroform mixed with a little Perspex sawdust. The tips of the wires, which are bent, are shown in Fig. 15, and the actual contact end clipped as shown in Fig. 10. The longest contact is 6 mm., the shortest is 4.5 mm. (this is the dimension before bending the contact ends).

The magnet is 7 mm. square by 4 mm. thick, with the poles as indicated in the diagram. The original came from a model gauge 00 train motor, but it may be possible to find a suitable equivalent from an old Kako or similar low priced Japanese motor. The corner should be ground off, not filed. Use Plasticine to remove magnetic particles.

* * *

The author is willing to supply magnets of the type used on the original for 500 lira, and sufficient spring for the reeds at 400 lira. Similarly he can supply the "Armco", but readers should not have any difficulty in obtaining this locally. (*His address is; G. Tortora, Viale dei 4 Venti, 128, Roma — Italy*).

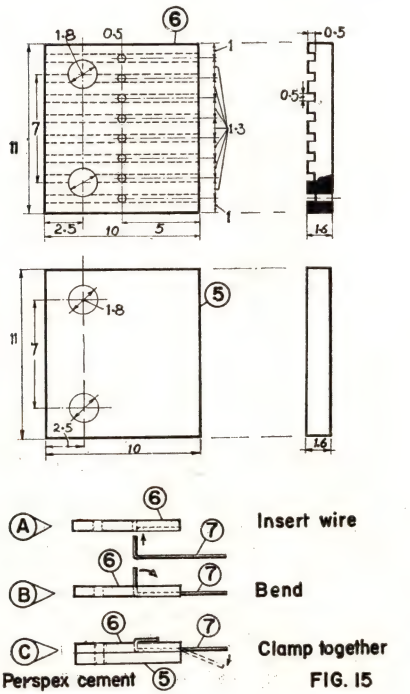


FIG. 15

(To be continued)

Gadgets and

FIRST, a big "Thank you" to our enthusiastic Gadgeteers who rallied in no uncertain manner to our plea for a few more bright ideas for this popular feature.

Control Stick (Sketch **A**)

First of two ideas by P. M. Holmes, makes good use of a Woolworth's plastic coat hook (costs 9d.). The colourful balls can be removed and glued on to the ends of $\frac{3}{16}$ in. diameter control sticks. Alternatively the longer of the two pegs may be used complete by filing to fit the appropriate socket in the pulse box mechanism.

Heat Sink (Sketch **B**)

If you have an old draughtsman's rule pen, you will find that this other Holme's idea makes a tight gripping heat sink for getting into tight corners. The handle of the pen may be discarded, and of course the adjusting screw provides plenty of clamping pressure on the wire.

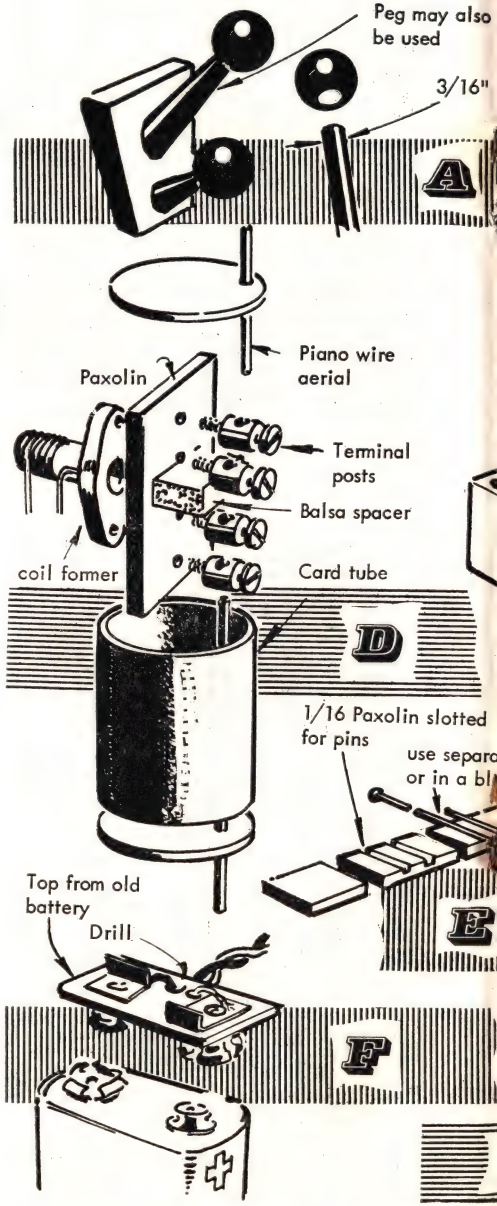
Simple Aerial Loading Assembly (Sketch **C**)

D. Anderson uses terminal posts, which are available from most radio component stockists; these are used to grip the ends of piano wire aerial rods and are screwed into a scrap of $\frac{1}{8}$ in. thick paxolin or perspex, forming a firm support. The Aladdin former for the loading coil is fitted on the opposite side of the plate and may be secured with nuts on the protruding ends of two of the terminal posts.

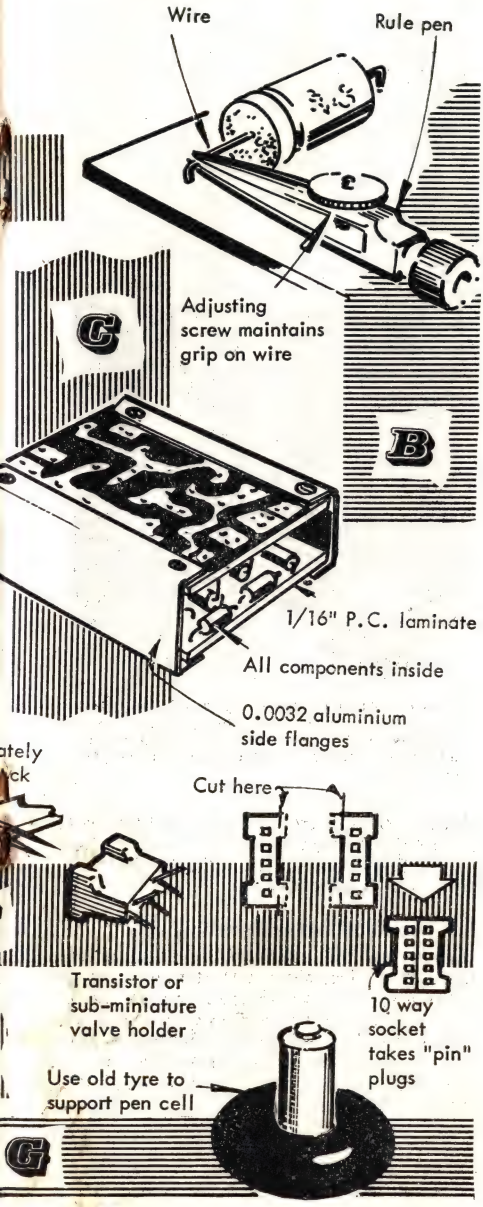
A large diameter paxolin, rolled paper, or card tube with end caps of similar material is slipped over the whole assembly to form a neat weather proof case.

Compact Receivers (Sketch **D**)

Doug Bolton gets down to postage stamp proportions when building tiny receivers, thanks to a two deck arrangement assembled on 0.0032 in. aluminium side plates, which form effective spacers, enclose the components and ensure a rigid assembly. Two printed circuitboards, $\frac{1}{16}$ in. or even thinner, are arranged so that all the components are sandwiched between the boards and that no shorts occur on the side panels. A few precious square fractions of an inch could be saved by placing plastic insulation tape over the edges of the board



Gimmickry



so permitting the flanges to cover some of the lands without ill effects.

Micro Miniature Plugs and Sockets (Sketch **E**)

J. Emmett has a variation on the subminiature valve holder theme. Two valve holders are cut down and cemented together as shown in the sketch, so that they form a ten way socket about $\frac{3}{8}$ in. square.

Separate two pin plugs may be used, or carefully made matching ten pin versions assembled. $\frac{1}{16}$ in. paxolin is used for this purpose and is slit carefully with a fine hacksaw to accommodate ordinary dressmaking pins. The heads are cut off and their points ensure easy insertion into the sockets. Araldite is used to retain the pins in their slots and plastic insulating tape supports the wire. Certainly useful for connecting up the "Half Pint 8", or in its smaller version as a single channel switch-cum-plug. We would suggest that some indication of polarity is incorporated, for example by filing off one of the protruding lugs on the valve holder and adding a further "dead" pin, slightly longer than the others, to the plug so that this fits the space where the lug would normally be.

Quick Connections (Sketch **F**)

P. C. Counsell has a good use for old batteries which have the snap fastener type of connections. As these are polarised it is a simple matter to remove the old cap from a used battery by tearing away the case and clipping the wire or metal strips which normally connect the clips to the cells, add a couple of leads in place of these, passing them through holes drilled in the plate to which fasteners are attached. Obviously the positive lead must now go on to the female stud on the holder, just as one would connect separate stud units. A little plastic insulating tape and thread binding will secure the leads firmly and reduce the chances of short circuits when in position.

Another Third Hand (Sketch **G**)

P. Evans has a quick dodge for supporting pen cells and similar batteries while soldering. Simply push the battery into the centre of an old sponge rubber or balloon tyre, this effectively stops them from being knocked over while leads are being attached.

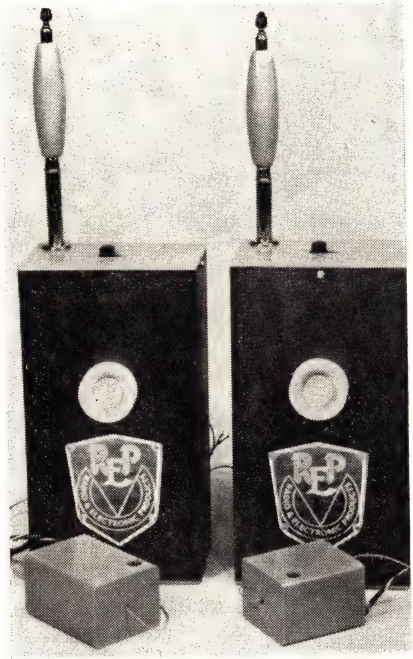
TWO AT A TIME ON A BUDGET . . .

"Project Gemini"

NEW R.E.P. FILTER OUTFITS DESCRIBED AND PUT TO THE TEST

MESSRS. R.E.P. have experimented with filters for a little while now, and have just followed up the success of their "Twin Triple" outfit, which, readers will recall, is an all transistorised receiver giving two separate outputs for escapements via tuned filter switchers. The transmitter being a fairly orthodox valve type.

Why not carry the thing a little further and operate two receivers, each with its own filter? This seemed entirely feasible and the next logical step was to use two transmitters to obtain independent control of two separate models flying or sailing together without the added expense and complication of using superhet receivers. The development of a complete all transistor transmitter and filter receiver outfit brought about the realisation of this ideal. We were fortunate to receive the first two from the production line and were soon testing this pair of "Gemini" outfits.



Snap ! The only difference here being the relay type receiver on the left and the relayless receiver on the right. Either make an almost interference free outfit for normal use.

What are its Applications ?

Two small single channel aircraft or boats may be operated quite close together and independently of each other. This permits reasonably interaction free sailing or flying in close proximity to the transmitters and with models as close as a few feet from each other. It should open up new possibilities for boats or even vehicles, and should permit the control of two model aeroplanes, say at opposite ends of the same field, almost entirely free from interaction.

The *receivers,* being filter types, are unlikely to be affected by other tone transmitters which key tone and carrier together.

Both relay and relayless versions of the receiver are available and the type used makes no difference to the selective functions when operating "two up". Naturally, only two different outfits may be operated together, that is to say the red and the green as opposed to two reds or two greens.

Are there any Limitations ?

With the receivers extremely close to each other, less than a foot apart, some interaction is experienced which only results in a slight lowering of sensitivity. It is absolutely impossible, however, for one transmitter to operate the other receiver, this is most important at close range. As both receivers operate from keyed modulation and tone, there is no blocking carrier to affect the other receiver under "No Signal" conditions. There is, however, and this seems to be

the only limitation, a blocking if both transmitters transmit signals together. This means that if the red transmitter is keyed; the red receiver responds, but if the green transmitter is then keyed at the same time, one of the following things may happen:

1. If the green transmitter is nearer the red receiver than its own red transmitter, the red receiver will lose the red tone and revert to neutral.

2. If the green transmitter is keyed first, relative positions being the same, then keying the red transmitter while the green signal is maintained will produce no response to the red receiver.

3. If the transmitters are close together and the models not too distant from them the situation can be rectified simply by stepping forward a few paces, or even waving the aerial a little closer to the model (at short range). The nearer of the two transmitters then takes over, so that control may be re-established or if you like, your fellow operator's control can be blocked! What one might call *duel* control.

Summing up

It all sounds a little complicated, but all it really means is that at medium to close range one cannot apply control of both models at *precisely* the same moment. The chances that both will key exactly together is quite remote and with the correctly trimmed model it is unnecessary to hold control on for lengthy periods. It should be perfectly safe to fly from opposite ends of an averaged sized club field without worrying about blocking.

A carrier switch is fitted to each transmitter to permit the use with other receivers which require a "continuous carrier, keyed modulation" mode of transmission. It is unnecessary to keep the carrier on when flying with the "Gemini" receivers, so the transmitter battery lasts longer and of course, blocking of the other receiver is more apparent under continuous carrier conditions.

Transmitter Design

The designers have made a great break away in constructional features with this outfit, an extremely clean anodised aluminium *rectangular tube* forms the case and grey moulded nylon end caps provide a neat finish the lower one giving access to the battery compartment which holds a single P.P.9, the upper one carries the supports for the printed circuit board aerial and carrier switch. A centrally placed keying button is fitted in a convenient position on the front of the tubular case. A useful feature of its design is the raised surround which prevents accidental operation of the transmitter when not in use. This facility has been carefully thought out and could well be applied to other transmitters with "live" keying. The central position of the button permits single handed launching, if necessary giving a correcting signal with the left thumb before transferring the transmitter to the right hand. A point to watch in hot weather, with this and some other all transistor Txs., is that damage may result if the key is pressed when the Tx. has been overheated. Keep it in the shade! Both transmitters are similar but with the following exceptions, two different crystals are used and the tone frequency is widely different; 850 c.p.s. on the green outfit, 3,200 c.p.s. on the red. Output is approximately 100 mW.

Circuits; as will be seen from Fig. 1, the transmitter employs five transistors which are employed in a push pull arrangement pulse modulated from a multi vibrator as modulation, switching the transmitter via an N.P.N. transistor. An interesting feature is the large diameter coaxial coils with what seems to be extra close coupling. The designer tells us this was an experiment that paid off in providing a better output when the π coupling is correctly adjusted.

We understand that during the factory test procedure, the transmitters are inserted in a special dummy case and are hand held while being tuned so that operating conditions are almost exactly duplicated.

The components are comfortably spaced and neatly laid out on the printed circuit board and an Arcoelectric microswitch mechanism is soldered directly to the lands so that its actuating lever engages in the keying button when the transmitter is in the case. The carrier switch and aerial are connected via flying leads, and the whole assembly retained in the case by four P.K. screws. The aerial retracts right down into the case, leaving only 4¾ in. with the loading coil protruding. Standard of workmanship is very good and the nature of the design would seem to facilitate ease of construction.

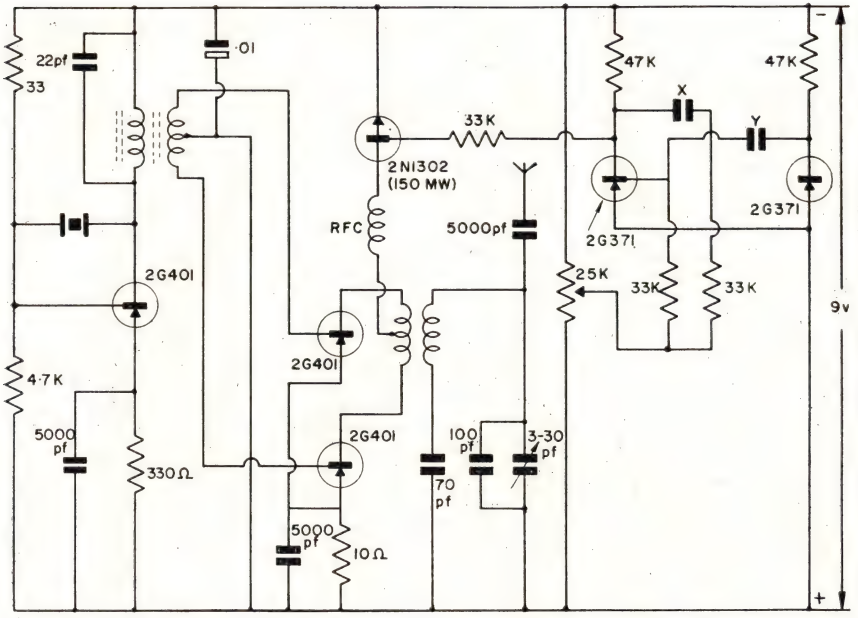


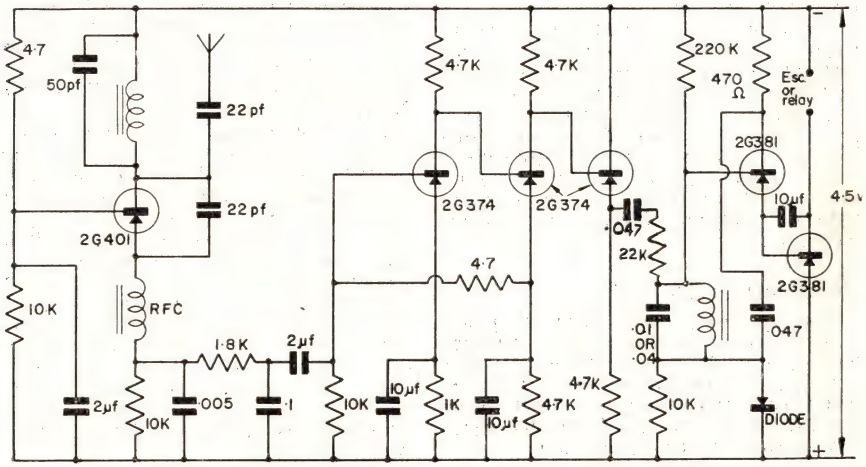
FIG. 1 **Transmitter**

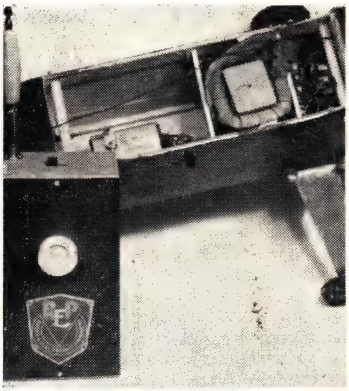
Receivers

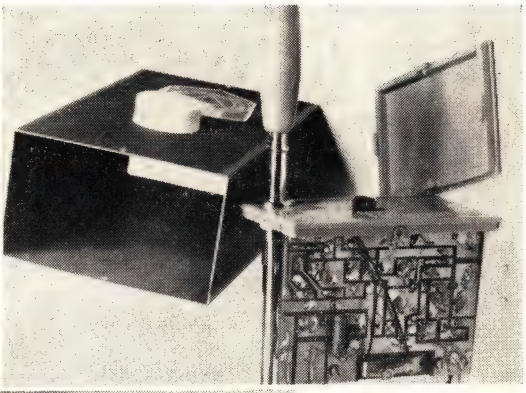
All transistorised circuits are used and are identical in both cases. Two versions are available, the only difference here being the addition of a $\frac{1}{3}$ oz., 75Ω relay across what would normally be the escapement connecting points.

The components are closely packed, carefully sleeved, arranged in an upright position and completely enclosed in a neat crash resistant nylon case, the end cover of which is cemented on, to prevent unauthorised and probably harmful fiddling, leaving just one access hole for tuning adjustment. (The examples submitted for test were open for inspection). The whole receiver is extremely robust and may be regarded as a good example of the miniature class.

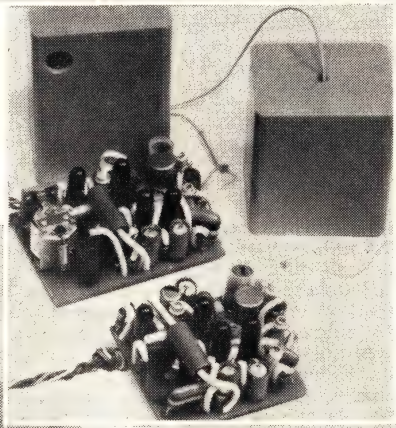
FIG. 2 **Receiver**



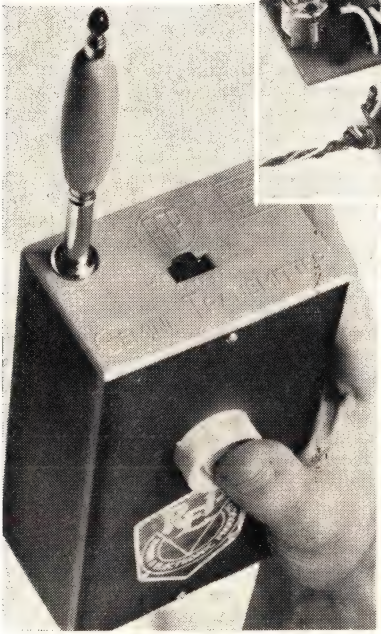


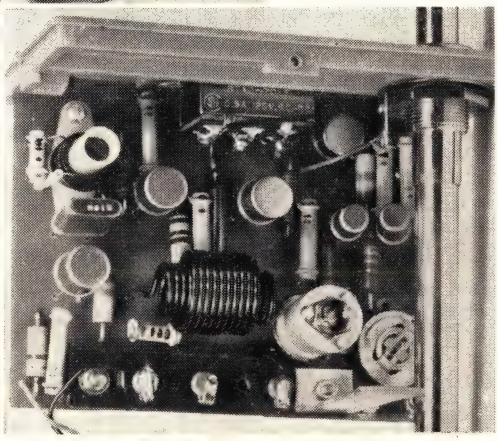


Prototype installation by R.E.P. for one of their tests in a Veron "Robot" shown above. Inside the neat tubular case we have a tidy P.C. board removed here for photograph on the right.



Left, the two receivers removed from their cases, relay above, relayless below. Note the careful sleeving of components and leads. The receivers are sealed in their cases normally, so refer to this picture rather than carve yours about! The aerials are colour coded to suit their respective transmitters; red aerial for high note, green aerial for low.





Left, all the data moulded on the nylon top panel. The keying button protector permits single handed operation ; for the thumb can rest on the edge of the button surround to keep a firm grip on the transmitter. Right, the transmitter panel components well spaced for ease of assembly, note the large diameter coils referred to in the text.

Test Figures

Red Transmitter

Modulation: Square wave (Pulse modulation or I.C.W.)
Total Current:
Carrier 22 mA., Mod. applied 14 mA. — Aerial Down.
Carrier 28 mA., Mod applied 17.5 mA. — Aerial Up.

Green Transmitter

Modulation: As above.
Total Current:
Carrier 24 mA., Mod. applied 17 mA. — Aerial Down.
Carrier 21.5 mA., Mod. applied 15.5 mA. — Aerial Up.

The field strength meter test indicated a slightly higher output when compared with the red transmitter. We have not tested two pieces of equipment of the *same design* before, some slight variation is understandable due to component tolerances and transistor characteristics.

Red Receiver

(Relayless version submitted for test).
No Signal 1.8 mA.
Carrier Only 1.65 mA.
Tone Signal 350 mA.

Receiver being connected to an 11 ohm escapement which unloaded, pulls in at 180 mA., and drops out at 40 mA. Sensitivity 8 microvolts, Filter response on 100 per cent modulated square or sinewave peaks at 3,200 c.p.s. and will still operate the escapement down to 2,800 c.p.s. and up to 3,600 c.p.s.

Green Receiver

(Relay version submitted for test).
No Signal 1.8 mA.
Carrier Only 1.7 mA.
Tone Signal 50 mA.

Relay pulls in at 35 mA. and falls out at 27 mA. (reading taken in battery supply lead). Sensitivity 7 microvolts. Filter response on 100 per cent modulated square or sinewave peaks at 850 c.p.s., relay falls out at 700 c.p.s. and at 1,500 c.p.s.

Interference

At close range there is a loss of 3 dBs when the carrier of the other transmitter is switched on, slightly less when that transmitter tone is keyed. The receivers are not prone to impulse interference, and the relay version is recommended for use with the "Unimite" single channel servo.

Complete Equipment Tests

Ground range checks were carried out using the aforementioned escapement with the red receiver and a "Unimite" with the green receiver. Both simultaneous keying of the transmitters approximately 10 yards apart and separate operation was carried out. The receivers were taken to a distance of approximately quarter of a mile when reliable operation was still possible. Bringing the *receivers* still closer together reduced the range slightly. And when an extreme test is carried out by bringing the receivers to within a foot of each other, it was found that one would still operate although this could be affected by tuning the other. This is most probably due to the fact that the two have slightly different tuning characteristics and a point can be reached when the normal radiation experienced with a super-regen receiver is brought sufficiently far away in frequency from the other receiver. It is most unlikely that models would be operated at such close proximity to each other when at extreme range. The next step was to prove to ourselves by means of simultaneous flight tests that the system as a whole is capable of such versatility. From our experiences seen so far, we can say that this system will enable modellers on a limited budget to operate two single channel models independently, thus saving valuable waiting time at the side of the runway or on the bank.

Physical Data

Transmitter: Case—6⅜ in. high, 3½ in. wide, 2⅛ in. deep.
Aerial Protruding — 4¾ in retracted, 48 in. extended.
Seven section, chrome plated with centre loading coil.
Weight — 9½ oz. + 14 oz. P.P.9 battery (9 volts).

Receiver

Relayless—1¾ in. x 1½ in. x 1¼ in.
Weight — 1½ oz. + 4.5 volt battery, depends on type used.
Leads: Red Rx. battery
black (two off) Rx. battery neg. and escapement
white escapement (+ polarity).

(*Continued on page* 295)

Starting with R/C Boats

BY R. P. MEREDETH — PART 2

In the March issue I described my first radio control model, faults included! The next model was an Aerokits Crash Tender which was electrically powered by a Taycol Torpedo with Exide accumulators. Control was affected by a similar motorised servo with limit switches for steering and a variable resistance operated on a quick blip sequence, by another geared motor. The 360° of rotary movement was split up into three sections which gave variable speed forward, neutral, then another section which brought into action a double pole change over relay to give half speed astern. The whole system required three channels, whilst it worked very well, it was not brilliant. You had to guess the position of the variable resistance and if you missed the desired section it had to be operated another 360° very haphazardly.

The model functioned well but was very slow, due to the weight of the accumulators. It was later sold to another interested party. In fairness to the makers of the kit, the same boat with a 2½ c.c. diesel, leaps along at a fair rate of knots.

The crash tender was followed by a "Sea Commander" again using the E.D. three channel receiver and transmitter. This differed slightly in that a panel of miniature 3 pin sockets was installed with corresponding plugs on the receiver wired to the relay leads in the following sequence; back contact, armature, and make contact. This proved valuable in that the receiver was easily removed for adjustment and general cleaning of the model, without running the risk of fouling other wires. The system is now used by many modellers. One should make a good soldered joint where the leads join the various positions on the plugs and sockets.

V.P. Props

The model was fitted with an E.D. Racer and had a reasonable turn of speed. I endeavoured to fit a variable pitch propeller to this model, based on an idea by George Bradwell of Birmingham about seven years ago in a Wavemaster. He could do anything with his boat which is still in operation today. Briefly, the variable pitch was effected by movement of the prop shaft up and down the prop tube over a distance of a ¼ in. The prop blades being separate with a concentric pin on the trailing edge of the blades engaging in a cunningly devised slot in a housing which was retained by the skeg, but rotated with the shaft. The blades were connected with a pinion through the shaft and housing. At the end of the tube (inside the boat) a follower operated by a Mighty Midget servo motor, engaged on a collar attached to the shaft, the follower was pivoted at about its midpoint and the other end fitted in a slot on a drum which starting one end of the drum traversed its diameter along its total length. The drum was operated by the Mighty Midget and quite a lot of power was available to move the prop shaft up and down the tube to alter the pitch. George Bradwell is the cleverest chap I have ever met on the design of inter-gear.

However, to get back to the "Commander" I had no lathe and depended on other people. The steering was a very early RipMax unit with a slipping clutch. The motor was suppressed with a 0.01 mfd. condensor, I made a twin butterfly throttle for the engine, a Mighty Midget, geared to a cam which slowly rotated giving a 360° movement controlled the flaps opening and closing the throttle as it did so. The model was first launched at Bournville and proved rather disappointing, since the variable pitch propeller mechanism constructed by me left a lot to be desired. It was too heavy for the model and very cumbersome by any standard. Since such gear was located on the starboard side, the model listed in that direction, and counterweights on the port side put the boat so low down in the water that I abandoned the V.P. idea.

Make or Buy

At this stage I am going to say something which will possibly bring a flood of letters of protest to the Editor, but here goes; most of the model fraternity prefer if possible to make what they need by themselves. It offers so much satisfaction in ownership, but unless you have a lathe or similar facilities no matter how clever you are there is a limit to what can be achieved with a power drill and file with which a certain degree of accuracy can be achieved, but (in the case of inter-gear) there comes the time when you want to turn that awkward bit of metal, and unless you have a friend who does not mind you using his lathe you are stumped. Many have been the offers to me of the use of a friend's lathe, but when the time came for it to be done, only they wanted to do it. Now this is a very gallant gesture by the owner, and providing he knows exactly what he is doing your job is in safe hands. yet it's not like doing it yourself.

You get the same set of circumstances with another offer, but this chap though the owner does not seem to know the difference between the headstock and the tailstock, with the result that often the piece of metal you purchase for the job (and metal isn't cheap) ends up as scrap. From this it should not be difficult to see what I am getting at. Endeavour to purchase either a small second-hand lathe at the right price (in good condition) or a universal unit like the "Unimat", which as a lathe costs just over £30. The latter is a small unit, but very efficient. If you have any engineering knowledge at all, you will find it a boon in making your own small parts; from flywheels to pistons and component parts of servos, etc. I have just bought one, and wish I had purchased it years ago.

The next model on the kitchen table was a freelance job. Vital statistics were 15 - 8 - 54 in., possibly not the variety you are used to, but these applied to a boat. It was a round bilge model, designed to carry a large power pack. Its construction is worthy of note, since it was built on a bulkhead former longeron style so consistent with aircraft construction. The outer skin was 1½ mm. ply covered with Irish Linen, suitably soaked in "Cascomite" and when dry covered with several layers of Linen and "Polyfiller" to obtain the desired curves. It was finished off with cellulose—the paint used being "Valspar".

I had reached the stage where I was dissatisfied with three channels and with a great deal of help from Chuck Doughty on the radio side, I built a six channel Super-regen, and adapted my transmitter control box for the additional three controls. The electric motor for propulsion was the "Taycol Supermarine" driven through a home-made reduction gear of two to one to a 3 in. dia. three bladed Web Screw. Steering was effected with a home-made rod and jockey servo, so with two channels for steering, and two operation a variable resistance again split into three sections I gave a great deal of thought to the use of the other two.

The model was an M.T.B., and having seen Arthur Bailey of Newcastle frighten the life out of the ducks on the pool with his special effects I felt that I would try, not necessarily to frighten the wild life but at least to have as much as possible in special effects working on the model. I allocated one channel to operate the hooter and navigation lights, with the second to operate a 12 position selector, which was operated on a rachet principle. A spur was attached to the armature of a relay recovered from an old Triang Railway Controller this engaged in a 12 toothed sprocket mounted on the underside of a panel, on which 12 contacts were arranged. To the sprocket pinion was insulated a sweeping contact carrying 6 volts from the positive side of an accumulator and also 1½ volts from a U2 cell. Contact number 12 was neutral and operated the Radar Scanner on the bridge. This being a visual indicator that all was safe, and the model was not liable to blow up. The remaining contacts operated Very Lights (not Bengal Matches) Depth Charges which were released and exploded in the water raised a ramp on which was a model I.C.B.M. which fired and made for the clouds at a high rate of knots when vertical. Laid a dense foul smelling smoke screen, fired two torpedoes, 10 airbursts, and a model gun to mention but a few. (*I cannot go into details of the explosives as there is a Home Office ruling on Pyrotechnics, so please don't ask.*) However, they were only operated to entertain the public on public regatta days. Sufficient to say that I possibly

hold the club altitude record at Bournville with the rocket out of sight. The method of ignition was a 2 amp. fuse coupled to a piece of Jetex which in turn ignited the service required. It is a highly dangerous pursuit and from experience I would warn would be special effects merchants to forget it, I suffered a badly burned hand in launching the model, so rigged, when a pirate transmitter came on the air and triggered the selector.

The M.T.B. carried a total weight of 79 lb. gross with the Supermarine motor installed, and was capable of fairly high speed, all things being taken into consideration as witnessed by competitors at the Premier Regatta of the I.R.C.M.S. in 1958, at Hull, when I acquired second prize in the special effects class. It might have been better but the selector jammed . I also fitted a 24 volts Lincoln Bomber pump motor to drive this boat, and carrying four motorcycle batteries as a power pack together with associated gear, the model weighed nearly 1 cwt. and was reasonably stable. Its buoyancy was such that you could push down on the hull in the water with all your might and you could not force the water over the deck, but it did have a tendency to roll in rough weather, and after three years it was scrapped.

The next venture was a "Marlin" which was 36 in. long, a very nice model, and used as an electric powered craft, with much the same type of gear as described in the M.T.B. To get a bit more zip I used Venner Silver Zinc accumulators, H.705's, and with this power pack and a 12 volt ex-W.D. Hughes motor, it would give any small diesel a run for its money. Unfortunately a friend trying to be helpful topped the accumulators up with distilled water to the top of the plates and ruined them. £21 after a month's use. So if you are using Venner accumulators read the instructions carefully, they have to be treated differently to a lead acid accumulator. Pure D.C. current for charging and when fully charged, little or no electrolyte should be visible.

The "Marlin" was then fitted with a 3½ c.c. diesel, and though a fair turn of speed resulted, the bows were too squat for a fast boat, and by now I was getting a little tired of battery charging before every trip to the pool, and my thoughts were turning to I/C engines as a permanent installation, of which I will tell you more next time.

PROJECT GEMINI

(*Continued from page* 292)

Relay Version

Size — 2⅜ in. x 1½ in. x 1¼ in.
Weight — 2 oz. + 4.5 volt battery for receiver, a separate 4.5 volt battery is recommended for the "Unimite" (this separate supply will depend on the type of servo or other mechanism to be switched by the relay).
Leads: Red Rx. battery +
black Rx. battery −
white relay armature
green relay make contact (N.O.)
blue relay back contact (N.C.)

The aerials are colour coded to suit their Txs. A switch is wired into the battery leads and output wires follow the standard colour code and terminate in polarised miniature plugs, eliminating any extra wiring in the model.

Manufacturer: Radio and Electronic Products, 75 South Western Road, St. Margarets, Twickenham, Middlesex.

Each matched pair (one receiver and one transmitter) £18.11.9d. (Relayless), £19.4.0d. (Relay).

Manufacturer's Comment

No comment necessary — a very fair report.

ARE YOU LICENCED ?

Just in case newcomers to Radio Control are not aware of it — you need a licence for operating remote control equipment. No tests, just fill in a form and pay £1 for five years' cover. Application form and full particulars from Radio Branch, Radio & Accommodation Dept., G.P.O. Headquarters, London, E.C.1.

Mighty Midget Drill

S. B. King describes an aid to P/C Builders

How many small drills have you broken so far with a hand drill on printed circuit boards? The ever faithful "Mighty Midget" motor may easily be modified to make an excellent little power drill for such light work as this. A few shillings wisely spent should be all that is needed, to convert a hitherto discarded motor, perhaps from an old servo, to a new lease of life in this way.

THE author recently produced quite a number of printed circuit boards and like a good many others has found that the most irksome task is the drilling of the very small holes. (One recent board — five servo amplifiers on one board — required 120 $\frac{1}{32}$ in. holes!) Small drills of the type required for this work have a very short life when used in a Black and Decker type drill, or in the normal hand brace, whilst the use of an Eclipse pin chuck is a long and laborious task.

With the above in mind other means of turning miniature twist drills were sought, the result being a home built version having the following specifications:—

1. Cheap to build — being an amateur. (It was, in fact, built entirely from the scrap box and in this day of the commercial servo most modellers will have a spare Mighty Midget or two).

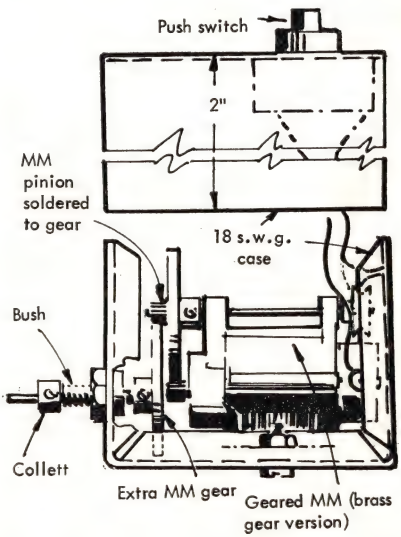
2. A hand held unit giving fine control.

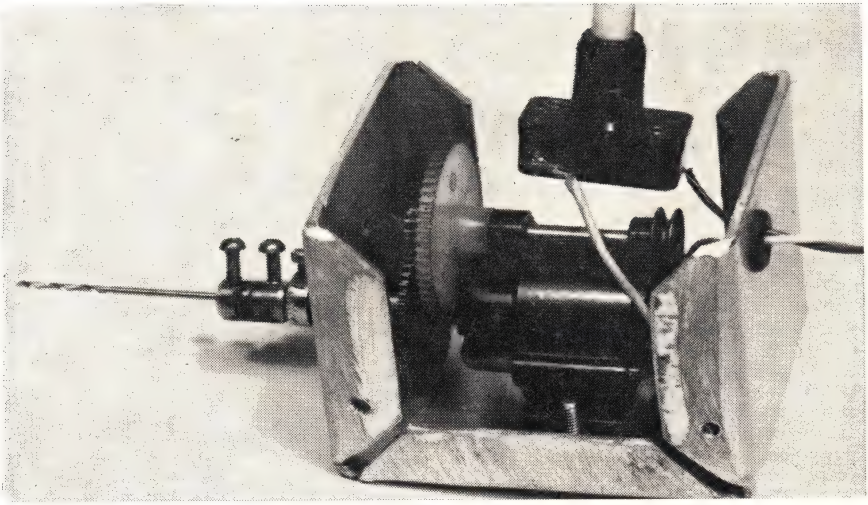
3. Reasonably slow-revving to avoid breakages and wandering.

4. Able to handle drills in the range of $\frac{1}{32}$ in. - $\frac{1}{16}$ in.

This unit is the result of one evening's work without recourse to elaborate machine tools. It was a "lash-up" to test the power available and the idea in general, a second version being envisaged with a small ball-race and a miniature chuck, robbed from a pin-vice. However, so successful was the first, that a second is now most unlikely. As already described, it set out to be a tool for use on printed circuit boards, a task it performs excellently. It can also be used as a miniature drill for metal, and it has been used successfully for drilling jets in brass spray bars and similar work.

Construction-wise, no description is really needed except perhaps for the drill holders; these are pieces cut from a $\frac{1}{4}$ in. brass held in the chuck of a slow revving drill firmly held down. (A hand brace held in a vice turned by someone else would probably do as well). The centre is marked by feeding in a triangular scriber. The drill to be fitted is then held in a pin-vice, and fed into the centre of the brass rod by hand, having drilled right through follow it half way





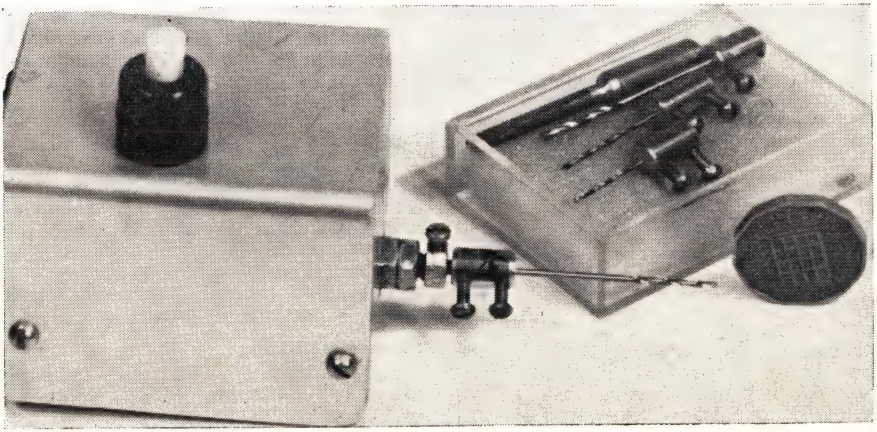
Simply bent and formed aluminium chassis shown with everything in place. If desired, the drill spindle bearing may be a brass prop. bush and could slide in a slot for correct gear mesh.

with a $\frac{3}{32}$ in. drill (output shaft size) remove, drill and tap the two 8 B.A. holes and insert retaining screws. Of course, the use of a lathe would be much simpler. There is no reason for the holders to be round, as long as both holes are in line, so a normal bench drill could be used. The author has merely described how his was made.

The bearing is made from an 0 B.A. brass bolt drilled out like a rubber model type prop shaft bush. As you will see by your own tests a silky fit is not essential, in fact a little play in the bearing can compensate for any mis-alignment in the drill holders — as long as the gears stay in mesh.

Well, it is adequate and is worthy of being passed on. Plug it into a 9 volt Grid Bias battery — holding it with the thumb on one side, using the index finger for depressing the switch and the other fingers on the other side. The P.C. board is held in the left hand, but watch your fingers!

Completed drill with its neatly presented set of accessories.



Bargain Basement

PART 2

Escapements

Small single channel boats or as sequential switchers in large craft may be equipped with escapements of the clockwork or rubber driven variety. Similar cleaning procedure may be used in this case for an escapement is virtually a high powered relay. Clockwork versions may have suffered spring damage due to corrosion, rubber driven escapements being rare in boat use should be easily serviced. Motorised movements are more readily dealt with under the heading of servos.

Servos

Some commercial model servos have a reasonable amount of protection against damp and oil but wherever possible especially on mechanisms with exposed contacts for centering or limit, careful cleaning is the keynote of success. Linkages may have become worn and in need of re-bushing. Mounting plates should be examined for warps, an uneven surface may distort the servo and reduce its efficiency.

Home built servos may range from a modified commercial job to a home brew comprising a model or government surplus motor, Meccano, clock or surplus gears and ex P.O. relay points, or home-made wiper type limit switches. Each version of this type will demand special attention if it is not operating correctly after the obvious contact cleaning procedure. Here again it is useful to have some form of catalogue reference as a means of identification for some of the government surplus motors which may be without connection diagram or colour code.

Switches

The old bogey of water, plus fuel, plus fumes, plus vibration (you can't win) may have taken its toll of the toggle and slide switches. Providing the switch can be stripped and reassembled without damage, cleaning may be attempted as follows. A wafer of card inserted between the points and worked to and fro whilst carbon tech. is applied should remove fuel coatings, signs of corrosion may also indicate that the metal itself has been weakened and care should be exercised to ensure that the attachment rivets and contact arms themselves do not become distorted or break off. Wiper type switches may be cleaned with very fine wet or dry sandpaper or fine emery under no circumstances should such procedure be adopted for contact points, burnishing with a piece of card should be sufficient, once the bulk of cleaning has been done. Some switches are a sealed unit and their mechanism is not accessible. The only cleaning method possible with this type is to immerse the whole switch in the cleaning fluid and operate repeatedly making sure any air has been replaced by the fluid and that all dirt has been thoroughly rinsed from the switch by subsequent dunkings. Provided the switch operates unfailingly over a multitude of test operations it is ready for reinstalling. An alternative, and perhaps safer method is to dissemble the switch by drilling out the rivets and reassembling with bolts after cleaning in the normal way.

Plugs and Sockets

Corrosion may have been set up on the pins of plugs, and even worse on the inside faces of the socket tubes. Care should be exercised when cleaning the latter; it is easy to prise the tubes open by too energetic use of a cleaning probe. Plugs themselves are simple enough to tackle but needless to say all wire connections to both plug and socket be examined for faulty insulation, corrosion and fatigue. It is good policy to number the plugs and sockets before removal as a means to identification should it be desired to retain the original circuitry.

Tag Boards

Some installations employ tag boards as a means of connecting various subassemblies such as servos and relays, very little need be said with regard to maintenance beyond the obvious precautions against corrosion damage or misplacement of adjacent tags which might cause short circuits.

Connecting Blocks

Here again we find a system of subassembly connection via a series of brass tubes in which the wire ends are

locked by set screws. The plastic casing carrying these tubes should not have suffered although the set screws may have corroded into their tubes. It would be advisable to soak such screws in penetrating oil for attempted removal.

Wiring

Whether the interconnecting circuitry takes the form of a birds nest or neatly layed harness, examine carefully for frayed or perished insulation caused by the action of fuel, dampness or abrasion from moving parts. Pay particular attention to the ends of all leads, lifting any clamping blocks and reinforcement sleeving so that the insulation and continuity of the wires may be seen. Suspect any unsupported and unclamped wire terminations in craft where vibration is expected to be present. The combination of corrosion and work hardening due to vibration can account for unexpected fractures of the leads. If it is intended to change the original circuitry it is probably a better policy to scrap rather than re-use the wires involved. Suitable colour coding and labelling should be used as a means of identification, taking into consideration those colours already used in the remaining section of the harness.

Unit Installations

Testing and cleaning is greatly facilitated by removable units, a complete relay/speed control unit may be taken out cleaned, tested and modified if necessary, then reinstalled without a lot of contortions with screwdriver and soldering iron. It pays to remove such units to check the undersides of their panels for tightness of fixing bolts, etc., and to inspect the condition of any wiring which may otherwise be hidden.

Tracing Circuitry

An electricity continuity check may now be carried out in case any breaks have not been established by any visual check. A meter set for ohms or a battery and bulb may be used (the receiver disconnected). It will be noted that the cleaning procedure has been attended to *before* testing ; should damage have been incurred before the cleaning its effect will now show up. If, however, testing has been conducted before cleaning and continuity shown, this may only have been a lucky example of an otherwise intermittent contact.

Testing with an ohm meter should not only establish the value of relay coils and resistances of voltage droppers but also any unwanted resistances in wires and through contacts. Likewise leakages to the earth bonding strip or between supposedly isolated sections. This checking procedure need only apply to servos and ancilliary equipment, main motor drive if electric, ignition system in the case of petrol motors battery wiring and other subharnesses; the receiver of course would have already been checked for operation.

Matching Replacements

Unless obviously unmatched one should attempt to replace any faulty part with a similar or as close a matched component as possible. Where complete sections are replaced it is possible to redesign all the internal sections thereof providing the supply and control system will give the required command and drive. Make sure that any such replacement equipment, as in the case of steering servos, are of sufficient power and operate with the appropriate speed for the craft in which they are used; i.e., fast powerful craft require a servo of similar characteristics, although there should be the facility for inching small amounts of control to avoid jerky movements, at the same time retaining the ability to get out of a tight corner safely.

Electric powered boats may require similar modifications to the resistance values or switching system should it be decided to use a substitute motor. Some forms may be found to provide a plentiful source of unwanted intereference, the fact which should influence the choice of a substitute, especially if the receiver itself is changed for one of less accommodating characteristics.

Reinstalling Equipment

Unless precautions have already been observed in the original gear should be sited sufficiently high to clear any water slopping around in the hold. Absorbent mats of foam plastic laid on the bottom of the equipment compartments and above which the gear is mounted are a worthwhile safeguard against saturation. Fuel-tight bulkheads to isolate the motor compartment and keeping the silencer and fuel tank clear of any wiring should reduce the possibility of damage from heat or oil.

The foregoing may also be observed when installing gear in new hulls.

Providing the original hull is sound, one of the first tests, is that of immersing the hull in a fish pool or bath, and removing hastily if water seeps in (some hulls may have dried with age or shrunk at the joints in common with full sized craft), although motor vibration and pondside prangery may have inflicted structural damage. In this case even a perfunctory spot of navigation with hooked up gear would be inadvisable, one does not want to go through the whole drying and cleaning procedure unnecessarily.

Rearranging the equipment on one or several removable panels should greatly aid installation in a new craft and should facilitate cleaning and servicing in the future.

Tips for Posterity

Perhaps the reader may at some time wish to dispose of a model and its equipment; for the benefit of any future owners or indeed in the case of an absent minded designer, a circuit diagram of the complete installation fitted inside the boat and varnished for protection will preserve the mysteries therein for posterity.

Experimental Superhet

Current Checks	No.Sig.	Carrier Only	With Modulation
Total Current	with 6v. 200 mA. bulb in actuator circuit		
	3.5-4.5 mA.	3.5-4.5 mA.	180-200 mA.
Tr7 Emitter Current	< 1 mA.	< 1 mA.	200-400 mA.

(10 ohms actuator coil).

*Total Current at other mod. frequency 30-40 mA.

For current checks with modulation, frequency of mod. was that frequency to which filter was tuned, i.e., (1050 c.p.s.). *See notes on type of modulation.

The following information was obtained in test carried out on the prototype.

Sensitivity: 20 microvolts modulated at 1050 c.p.s. to a depth of 100 per cent gave a current rise of 300 mA. in 10 ohms.

Selectivity: (I.F. amplifier Bandwidth) 10 Kc/s at – 6dB points.

A.F. Amplifier response: ± 2 dBs from 700-7000 c.p.s.

A.F. Filter Bandwidth: Approximately 300 c.p.s. at 1050 c.p.s.

Stability of Self Oscillating Mixer

As a check, a tone modulated, self excited oscillator transmitter was set up and left running for two hours. The receiver was left tuned to this frequency and checks were made at intervals to see whether the output level at the receiving end had changed due to oscillator drift. The signal remained constant enough for all practical purposes. However, it is felt that some stabilization of the receiver oscillator is advisable and work is proceeding along these lines, using a Zener diode.

A.G.C. Action

Although this could be better; there is a tendency for the receiver to "block" momentarily on very strong signals. This effect is not quite as great with pulse modulated transmitters and is hardly any trouble at all. Once ranges in excess of 50 yards take effect on the transmitter level. If short ranges are to be used, the receiver aerial length may be reduced to 12 or even 6 in., also the transmitter power may be reduced.

The current drawn by the Rx. at frequencies of modulation other than at the frequencies of the filter or filters is taken mainly by the OC72 when under drive conditions.

Conclusion

As is mentioned earlier, the receiver is a prototype intended mainly to give a starting point for work on more specialised model control receivers. Therefore there is no reason why parts of the circuit should not be incorporated on anyone's own brain-child. For example, the Superhet. R.F. I.F. detector circuit could be used as a front end to an A.F. amplifier with a tuned reed output unit; or the A.F., A.F. Filter and switching rear end could be used with a Super-regen Detector circuit. Finally it is suggested that if anyone should find ways of further improving this prototype, that they tabulate them in a convenient form and give R.C.M. & E. readers the benefit of their experiments.

Commercial Developments

By TONY DOWDESWELL

CONSUMER STAFF MEMBER SAMPLES NEW PRODUCTS AT HOME & ABROAD

INTERESTING letter from Ken Smalley of **Otarion Electronics** in New York reveals the answer to the danger of burn out in the Otarion 0-31 transmitter as mentioned in the review of that item last month. The danger was quoted from the instruction sheet, being that with aerial removed, accidental prolonged keying would cause the output transistor to burn out. This danger would appear very remote in fact, and only likely to occur in very hot weather, around 120° F. The hypothetical situation envisaged by the instructions was one with the transmitter lying keyed in the "hot house" boot of a car.

Ken also tells us that the Otarion 0-21 is now modified to alleviate the close range blocking affect (flooding or swamping) to which early examples were prone.

A week or two ago we were able to examine one of the new **Orbit 12** channel superhet sets, just arrived at Henry J. Nicholls' shop, Holloway Road, London, N.7. The six volt all transistor superhet receiver has a new **Medco** twelve reed bank, which appears to be its only deviation from the earlier ten channel unit. Those already familiar with the Medco reed bank will be interested to know that on the "twelve" bank, the adjustable contacts are staggered, presumably to accommodate all twelve on the contact board. The matching transmitter is similar to the Orbit 10 all transistor type reviewed in this column, July 1962, but has an extra lever on the right hand side below the rudder lever. This extra lever for channels eleven and twelve has up/down movement, these two channels using the rudder/aileron modulator. The transmitter, which has an edgewise meter on the front face to monitor battery power and transmitter output, is equipped with 6 volt rechargeable battery and the set retails at £115.0.0d.

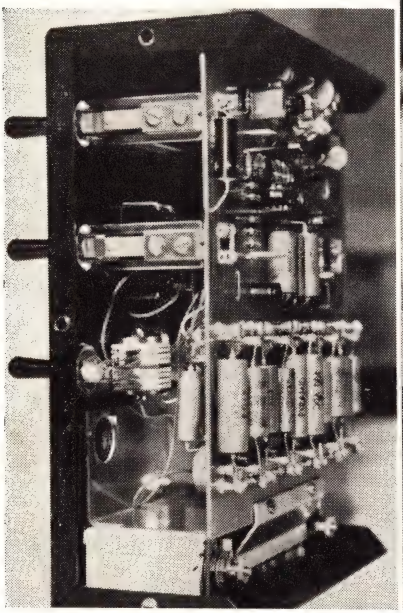
How to use those extra two channels? Well, the most spectacular would be retracting undercarriage, though there are also trim aileron, brakes, flaps, or . . . well, you name it!

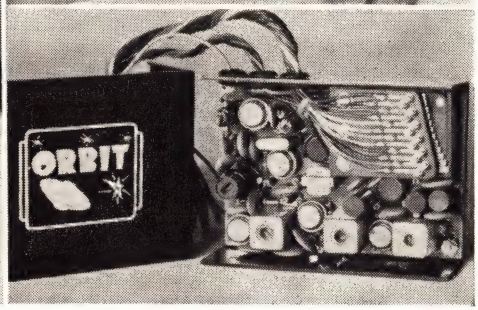
The **Gremlin Lancer,** 48 in. span rudder/engine aircraft kit, mentioned last month, makes up into a very strong airframe. One of the points which enthused our builder were the trailing edge strips of spruce. The review example is destined for four channel home made gear and home made servos plus Frog 500 motor. Just a reminder, the kit costs £4.19.6d. and is a product of Bradshaw Model Products.

Home constructors (and our readership survey tell us that a large proportion of our readers build their own equipment), will welcome news of really subminiature radio components. **Oakfield Radio** have a line of really microminiature resistors and subminiature ceramic capacitors. The capacitors in 470, 680, 1000, 1500, 2200, 3300, and 4700 pf. values cost 10½d. each. The resistors are all 1/10 W. at 5 per cent tolerance and all values are available say the suppliers. Price for single resistors is 8d. each, but per dozen assorted or over, this is reduced to 7d. each. Those who have difficulty in obtaining enamelled copper wire in the exact size they require, should know that Oakfield have this commodity in 26, 28, 30, 32, 34, 36, 38, 40, 42, 45 and 46 s.w.g. gauges. The wire is supplied on a small bobbin as illustrated. Prices for the different gauges vary and the finer the wire, the greater the price, so the length supplied is adjusted with each gauge to provide fair value for money at the standard price of 1/- per bobbin. Also available are a full range of Ardente transistor holders, each at 1/9d.

Probably the most extensively prefabricated radio control kit yet for a model aeroplane is **Top Flite's Taurus,** the creation of world famous multi flier Ed. Kazmirski. Top Flite have obviously spared no effort and it is indeed a remarkable kit. The trend-setting feature of the "Taurus" is its thick (19 per cent) wing section with blunt leading edge, around which sheet balsa is

The new Orbit 12, photographed from H. J. Nicholls' stock, demonstrating the vertical operation of the switch for the additional two channels on the right. A special "sideways action" switch for this purpose, may be seen in the inside shot below. Note also the easy change tone capacitors on the lower part of the P.C. panel. Bottom right: Orbit Superhet with Medco reed unit.

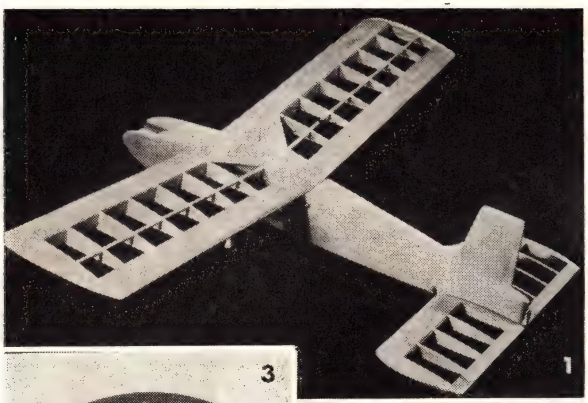


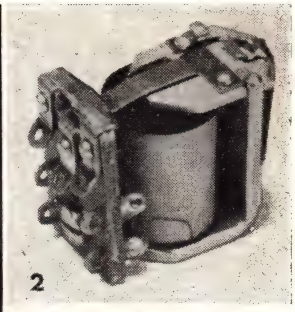


wrapped to give a constant leading edge shape from tip to tip. In the kit this leading edge sheet wrap is provided preformed, and the sketches of the wing assembly show how this is assembled to the wing and how the complete wing is jig assembled to prevent warps. Other preformed components are the strip ailerons, elevators, tip blocks ready hollowed out, fuselage top decking besides die cutting of practically all balsa and ply components. Radio installation details are all provided on the plan, they are very explicit, and some are illustrated here. Another feature of the kit is the provision of a steerable nose wheel assembly, plus printed book of instructions for building and flying Taurus, written by Ed. Kazmirski himself. By no stretch of the imagination can this kit be considered anything but extremely expensive at £13.10.0d., but for those who appreciate good kitting it will be of particular interest. Taurus is an out and out competition aeroplane, and requires some multi experience. We published a three view drawing of this design in our October, 1962, issue. Roland Scott Ltd. supplied the kit for us to examine.

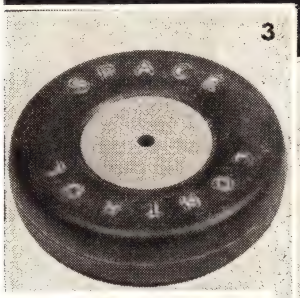
From Ed. Johnson came three **Ace Radio Control** kits for examination. First is a receiver power converter boosting 4.8 volts to 30 volts for receivers employing valves for 30 volt operation. All components are provided and when made up on glass fibre etched circuit baseboard the unit fits into a very neat transparent plastic box size 1 x 1 x ⅝ in. This unit has more than ample output to operate any of the existing 30 volt receivers from a 4.8 volt servo battery input, for max. load of 15 mA. Full instructions are provided in the usual thorough Ace manner, and the kit like all other Ace offerings is a thoroughly well prepared item priced at £4.16.0d.

Looking for a transmitter power con-



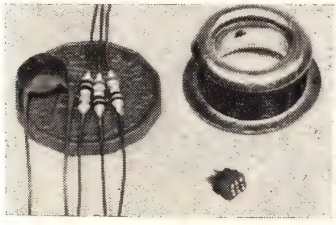


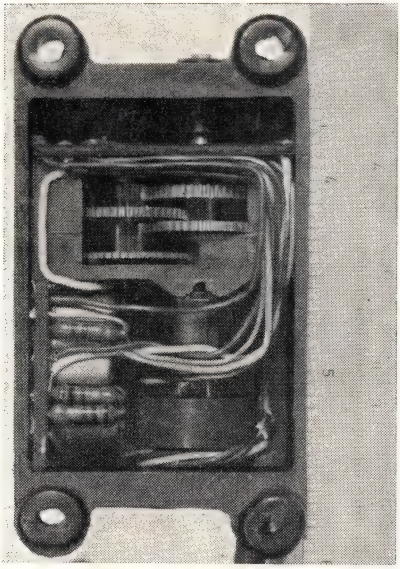
1. Gremlin 'Lancer' airframe. Completed it weighed 4½ lbs. and from half spiral would execute consecutive opposite rol's. 2. Deans relays weighs approximately ½ oz.



3. Space Control wheel has hard rubber tyre. 4. Components of Ace Transverter, transmitter power converter kit. Works from 3.6 volts rechargeable battery pack.

5. Ace receiver power convertor components. It boosts 4.8 volts to 35 off load, but receiver load reduces this to 30 volts. Operates from servo DEAC pack. 6. Ace Kraft KR10SH superhet receiver is supplied partially assembled. Features Medco reed bank. Below: Capacitors and resistors from Oakfield Radio. Sample bobbin of E.C. wire (1s. 0d. quantity is larger). Small object is transistor holder. R.E.P. centre loaded aerial is well produced.





Above : Inside the new R.C.S. servo shown full size. Compact transistor amplifier and tough nylon case. Below: R.C.S. 12 channel superhet set. The six keying levers are neatly arranged and captioned.

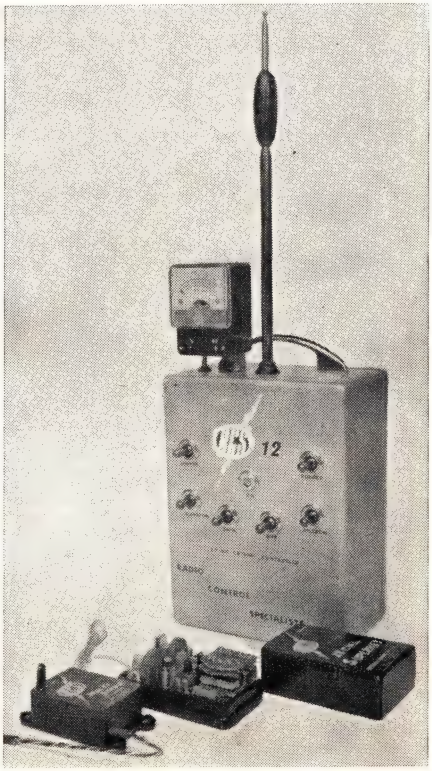
verter ? Ed. has the **Ace A3.6CK Transverter** in kit form which, when assembled, boosts 3.6 volts to 135 volts at 20 milliamps, which will suffice for most existing valve transmitters. There is a little more to this one than the receiver converter but with the aid of the instructions requires no more soldering skill to assemble. As might be expected, the unit is assembled on an etched circuit baseboard. This converter will draw about 1 Amp. and for power supply Ed. recommends the D 4.5 DEAC cell. Three are required and they cost 48/- each. The converter itself is priced at £6.9.0d.

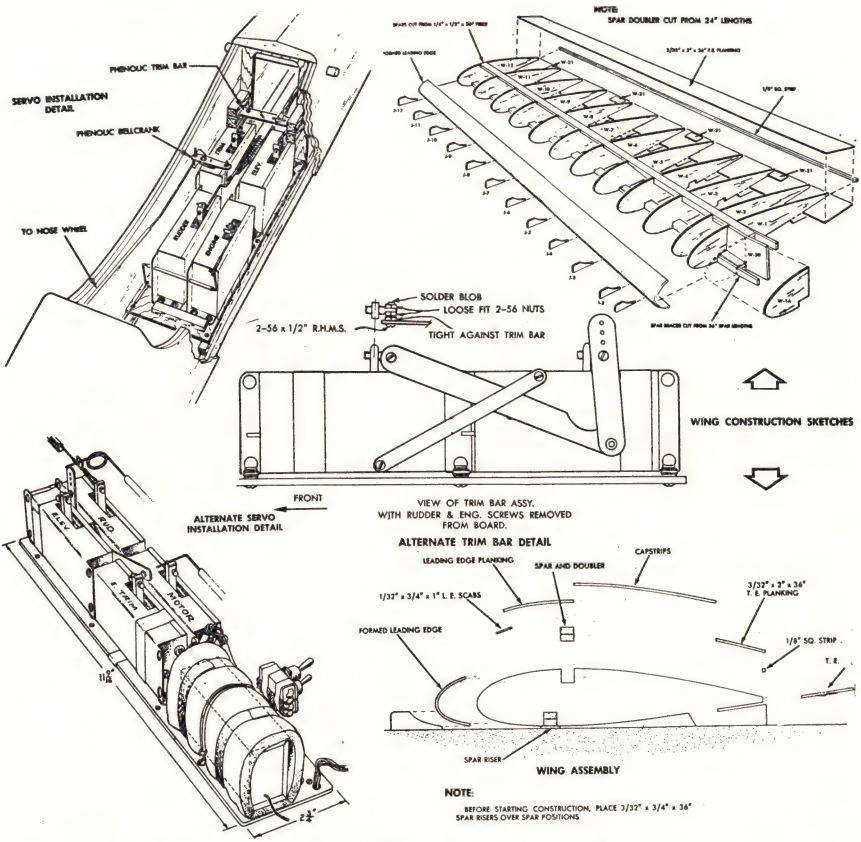
In addition a fourth DEAC can be used to replace the transmitter L.T.

We first reviewed the **Ace Kraft KR10HK** 10 channel relayless superhet receiver kit in September, 1962, Commercial Developments. Home building of a superhet is without doubt quite an effort, and the KR10HK was completely unassembled. Now we have the Ace Kraft KR10SH receiver which fulfils the same function. But much of the assembly work is already complete though at the same time allowing the not so expert do-it-yourself enthusiast to provide himself with a superhet which is still very much his own effort. Good instructions are provided here, too, and it seems that the kit suppliers and designers have safeguarded against any eventuality that might confuse. Ed.'s price for this superhet is £31.17.6d. Other items from the same source include a **Space Control Wheel** of 2½ in. diameter with solid rubber tyre. Claimed by Ed. to be the only wheel that would stand the use as a nosewheel on his 9¼ lb. "Big Daddy". Price 18/-. Also in stock are Deans relays of 50 ohm and 5000 ohm resistance at 29/6d. A reminder from Ed. concerns one of the French switches mentioned in the April edition. This is a double pole slide switch with knife action, which Ed. has sold for a considerable time, price 3/-.

A new line from **Radio & Electronic Products** is a centre loaded collapsible aerial. This 49 in., 7 section unit, collapses to 10¾ in. and costs 22/6d., a reasonable price for this chrome plated item.

Just received is an advanced illustra-





Installation and constructional details taken from plan supplied with Top Flite Taurus kit. Top left: Servo installation showing servos mounted two abreast down the fuselage. Note trim bar linkage to the rear of the compartment plus the bellcrank arrangement to the steerable nosewheel link. The Motor control linkage passes across the fuselage from left to right, passing through the mounting lugs of both rudder and engine servos. Bottom left shows alternative installation on one tray with receiver mounted edgewise down the fuselage. Drive to steerable nosewheel is taken from rudder push-rod and is coiled where it meets the rudder link, to prevent fracture of the servo drive arm in the event of a mishap causing overstrain. Centre is the trim bar link for this installation. Elevator trim servo is on the left and the keeper from the bottom of the trim servo to the top of the elevator servo prevents the two from moving, relative to each other. Wing assembly details at top and bottom right are self explanatory but very interesting.

tion of the new **R.C.S. twelve channel gear.** At time of writing we do not know a great deal about this set although some interesting and encouraging facts have come to light. The receiver measures only 3 x $1\frac{5}{8}$ x $1\frac{1}{2}$ in. and weighs just 3 oz. which is remarkably light. It is all transistor, working off 9 volts but the most important feature is the use of transfilters, a fixed value component which replaces the normal I.F. can of a superhet and is a considerable technical advance in the design of this type of equipment. The receiver also has a completely new reed bank of R.C.S. design. The reed bank alone costs £5.8.0d. and the receiver is £39.0.0d.

Matching this receiver is a 12 volt all transistor transmitter which measures only 7 x 5 x 3 in. and weighs (presumably complete with battery), just $2\frac{1}{2}$ lb. This costs £49.0.0d.

(*Concluded on page* 306)

To match this transmitter / receiver combination is a new servo measuring 2 x 1½ x ¾ in. and weighing only 2 oz. This is a transistor amplified unit which eliminates the centre tapping of the battery, is fully fail-safe and works on 4.5-6 volts. Pull is 18 oz., throw is 7/16 in., and priced at £8.10.0d.

A special meter measures R.F. power and battery voltage under load. It plugs into the transmitter and may be used also to monitor voltage on receiver batteries. This item costs £4.0.0d. but is supplied free with transmitter, receiver and six servos.

This month's review has certainly been one of high priced "cream" items, let's hope next month there will be a little more for the single channel enthusiast.

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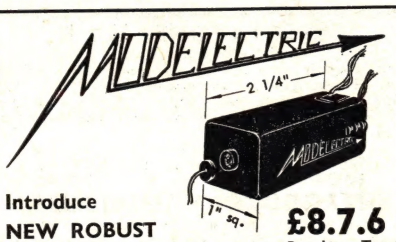

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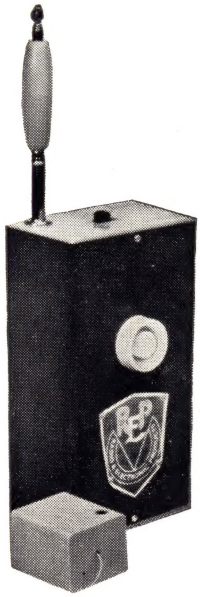

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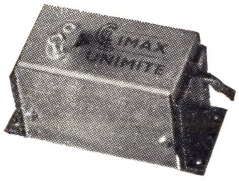

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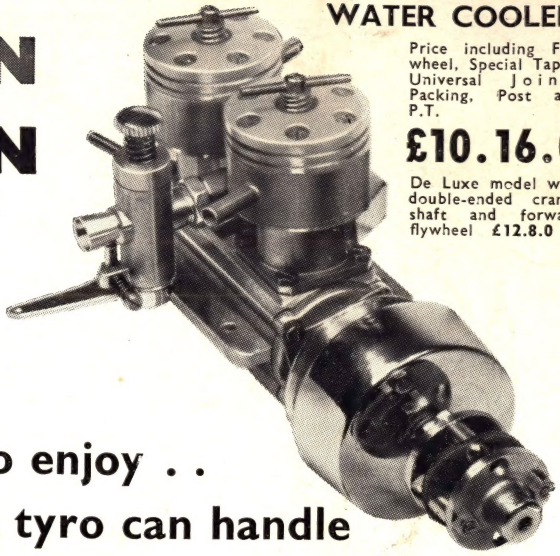

VITAL STATISTICS

Bore : .705 ; Stroke : .625 ; CAPACITY: 8 c.c. (nominal); Weight (W/C) without flywheel: 17 oz., Aircooled: 15 oz.; Fixing holes (laterally and longitudinally): 1½ in. ; Max. Ht. : 3½ in.; Max. Width : 2⅜ in.

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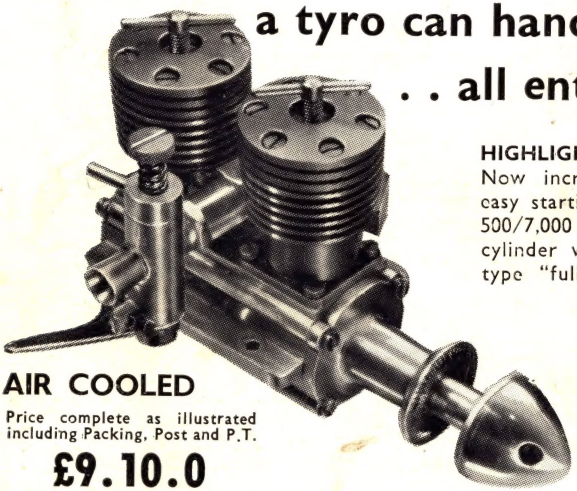

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